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Cable Investigation Shows Results

VIGOROUS prosecution of cable study by manufacturers, operating men and scientists is continually showing valuable practical results, steadily reducing the number of breakdowns and opening wider fields for the application of high-tension cables. The study of lead-sheath losses that brought out many definite facts in regard to these losses in single-conductor cable led to the development of means for reducing the losses and is making the use of single-conductor high-tension cable more and more feasible. The careful study of the field within a cable and the dielectric stresses therein has shown that the so-called type H is very desirable for three-conductor cable—a conclusion now generally accepted even by those who formerly frowned on this type of cable and one proved by the remarkably low percentage of breakdowns. The majority of manufacturers are now producing this type of cable.

A significant result of the investigations is the conclusion that high-tension cable must be maintained. It cannot merely be manufactured and installed and then left to itself, and since it must be maintained, it must be so constructed as to be maintained readily. Hence the soft compound for joints, hence the oil reservoirs on joints, and hence the most promising method of high-tension cable insulation—oil. It is indeed very promising for the future that a start has been made toward three-phase oil-insulated cable. Both the type H idea and the oil idea are importations from abroad, one from Germany, the other from Italy. But both underwent considerable further development in this country and point to the practical elimination of cable failures in the reasonably near future.

* * * *

Developing a Regional Picture

ACQUISITIONS of local power companies by holding companies have long ceased to be novelties. Their news value and significance, however, continue to arouse interest very much in proportion to the geographical key position, present and potential earning power involved. The importance of a merger in a regional power market development is freshly illustrated in the acquisition of the Worcester Electric Light Company by the New England Power Association. The alchemy of fluid gold here brings out some high lights in a picture whose perspectives point toward an ultimate unification of power supply in central and eastern New England far surpassing previous accomplishments in that industrially diversified and thickly populated area.

The Worcester company's future has been a subject for industry speculation for several years because of its strategic location, earning power and territorial diversity and compactness. Competition to obtain control of it was keen up to the final day of negotiations. Its acquisition by the Power Association closes an important gap in the system structure of that organization, opens the door to improved co-ordination of hydro-electric and steam generating plant facilities, and thus promises a more economical transmission and distribution of power over a larger area. This prospective gain in regional efficiency of power supply should offset the loss of control.

Commercial expansion, already alert, may be expected to increase after affiliation with a rapidly developing centralized sales organization, and it can scarcely be doubted that the rate situation will improve at no distant date, considering the headway now being made in Massachusetts by promotional tariffs. The cost of acquisition, $226 per share of $25 par value, must be measured against the prospective earning power of a property of unusual strength and possibilities plus the advantages of a key location in respect to the Power Association's load center and transmission network. There can be little doubt that this organization's purchase of the Worcester property will in years to come rank with its most far-sighted achievements, if the engineering, operating, commercial and economic possibilities of the new set-up are developed and co-ordinated with skill and energy, foresight and understanding of the technical and human problems involved.

* * * *

Improved Steam-Station Economy

THROUGH the Geological Survey, Department of the Interior, proof of the marked economy attending steam-station production of electricity by the public utility companies of the country is given. Last year more than 53 billion kilowatt-hours of electricity was generated by the use of fuels, and of this amount coal was used in the generation of 88 per cent. While the total amount of electricity generated by the use of fuels in 1928 was 5.5 per cent more than in 1927, the amount of fuel consumed was only 1.1 per cent more, the average rate for 1928 being 1.76 pounds per kilowatt-hour compared with 1.84 pounds in 1927. Thus a saving of 2,120,000 tons of coal was effected, equivalent to many millions of dollars. Compared with good steam-station performances ten years ago, the rate last year shows a decrease or saving of almost 50 per cent and indicates the marked improvement brought about in steam-station performances through more efficient equipment and better operating practices.

Naturally, such economy, although adverse to the coal-mining industry, adds to the earning power of the public utility companies, if not attained at too great a cost, and makes for lower rates to the public. The electric light and power companies, it must be remembered, save not only the cost of the coal but its trans-

portation, its handling and rehandling, the wear and tear of equipment and the removal of the ashes. Ten years ago 3.2 pounds of coal had to be burned to produce a kilowatt-hour of electrical energy. At that rate 38,000,000 additional tons of coal would have had to be consumed last year to produce the output. As a matter of fact, the total saving over the ten-year period is approximately 200,000,000 tons, or $1,000,000,000. Much of this is offset by the added cost of more efficient steam equipment; but to have effected the saving of 38,000,000 tons alone would have justified an expenditure for boilers and turbines of the magnitude of $1,000,000,000. Considering that fuel accounts for 60 per cent of the output, that water-power development costs more than steam-station development, that stations represent only a part of the capitalization of the industry, and that boilers and turbines are a small part of steam stations, where is the justification of the claims so often made that the present capitalization of the electric light and power industry is excessive and represents vast dilution?

* * * *

Made for All Work

ELECTRICITY continues to ingratiate itself into the daily life of mankind with warranted insistence. The less interesting routine tasks may be delegated to uncomplaining robots, and this is not only desirable but absolutely necessary if humanity is to carry on in these hectic days. The layman is able to comprehend that motors lighten tasks and are easily adaptable to varying duties, that good lighting insures better work and morale, and that steady, perfectly controlled heat means a uniformly higher grade of product. But when an appreciation of these elementary applications has been gained the more subtle refinements leave the non-technical individual in a state of bewildered appreciation.

The photo-electric cell is but one of the many mediums for effecting modern miracles. At the annual meeting of the American Institute John V. Breisky cited a few of the purposes to which this and related vacuum-tube devices can be applied. Automatic detection and extinguishing of a fire, counting of materials and people, controlling traffic by means of the shadow of the vehicle, sorting materials according to color or subjecting them to automatic inspection following manufacturing processes—these were a few of the many applications. As pointed out by Dr. Clayton H. Sharp at the recent meeting of the American Association for the Advancement of Science, photo-electric photometry has largely supplanted the judgment of individuals for industrial purposes and in testing laboratories. The problem of measuring sources of light of different colors has been solved through the utilization of a cathode coated with a monomolecular layer of cæsium, the light sensitivity curve for which approaches closely the sensitivity curve of the eye.

The meeting devoted to instruments and measurements at the winter convention of the American Institute of Electrical Engineers offered further testimony of some of the things that electricity can do even in what have hitherto been considered to be non-electrical fields. Magnetic analysis has been developed to the point where not only imperfections and flaws may be determined but the chemical composition and the traces of certain elements can be distinguished. The causes of noise in electrical machinery or mechanical devices are being determined by analyzing sound emissivity electrically. Better designs of hydro plants may result from the increasing knowledge of pulsation phenomena in draft tubes and penstocks as determined by electrical vibration recorders.

The element of human fallibility and error in judgment is being reduced in many activities, and the fatigue of routine may some day be banished by this reliable and untiring genie of the unknown.

* * * *

Why Weatherproof Wire?

ANNUALLY the quantity of weatherproof wire used for overhead distribution circuits, of both primary and secondary voltages, runs into millions of pounds. The amount already in service can only be guessed at. After a surprisingly short period the weatherproof covering peels off and hangs like Southern moss, adding nothing to the beauty of the pole line. More important still, the insulating qualities of weatherproof wire are very questionable after it has been exposed to the sun's baking rays for a time. As a consequence the insulation gives a false sense of protection to firemen, mischievous children and others who may be led to touch the conductors. The question of imperfect insulation is constantly coming up in damage suits brought because of a death or injury from electric shock.

If the additional cost of weatherproof wire over bare copper cannot be justified by the protection it affords, its use should be abandoned. But the only way in which it can be made a thing of the past in territories enforcing the National Electrical Safety Code, or its equivalent, is for a number of utility companies to submit to an impartial test samples of weatherproof wire which have been in service for a varying number of years. That one section of a line may be adequately insulated is not proof of the value of such wire if other sections do not give protection. It is the uncertainty of the insulation that makes its value questionable, and data are needed to give a complete answer concerning the protective aspects of this wire.

* * * *

Protection Needed for High-Voltage Breakers and Buses

RECENT explosion of a 33-kv. indoor oil circuit breaker on the Pacific Coast, causing loss of life and serious property damage, is just one more case serving to emphasize the importance of outdoor high-voltage breaker installations or the use of some system of bus protection. In the present state of the art it would be difficult to find an engineer who favors housing high-voltage equipment except under circumstances where there is no alternative, as in the case of substations in congested city areas where the amount of property available is a limiting factor. It is illustrative of the trend toward outdoor bus and breaker installations that one Pacific Coast power company is going so far as to locate outdoors the 11-kv. bus and oil circuit breakers for a new steam plant.

Outdoor high-voltage breaker installations are a step in the right direction, but, irrespective of whether they are indoors or outdoors, it must be recognized that bus protection has become the fundamental consideration. Several systems of bus protection have been developed, many of which have proved to be highly effective. In one system frequently used the sum of the outgoing feeder currents is balanced against the input to the bus, and as

long as conditions are normal no current flows in the protective relays. Should, however, trouble develop on the bus or in an oil circuit breaker, the sum of the currents will no longer be zero and the bus will be isolated immediately.

Bus protection and the rebuilding of indoor high-voltage substations are expensive, but the serious hazards involved and the danger of interruption to service may outweigh the matter of cost and justify the expense of bringing many old installations up to date.

* * * *

Condenser-Motor Progress

THAT so much attention should have been devoted to the design and theory of condenser motors at the winter convention of the American Institute of Electrical Engineers is adequate testimony to the coming significance of this type. Being relatively new, there are many elements which are still to be fully determined.

It seems evident, in the light of present knowledge, that the amount of copper in main and capacitor windings will be varied to give more to the former and less to the latter, and that two condensers may be incorporated so that one will serve for starting and the other for running, a speed control effecting the change-over. Probably, vastly better condensers with greatly improved life characteristics may be anticipated. The reversing ability of the condenser motor has not been proved to be inherent, the external reactance being the dominant factor. The lower pull-out torque and similar properties of this form of induction motor do not suggest its use in place of polyphase equipment. The much-discussed greater cost is a function of the starting torque and power-factor correction desired.

The demand for quieter single-phase, fractional-horsepower motors, with better starting torque and power factor and with minimized radio interference, led to the revival of interest in the condenser motor and will in all probability likewise lead to its full development and the mastering of the difficulties whose solution called for it. The fundamentals were known and expressed many years ago. Steinmetz contributed to their elucidation, and the practice now follows the theory.

* * * *

Where Will You Meter?

IN SPITE of determined and uncompromising opposition on the part of metermen who have not tried it, outdoor domestic metering is at least gaining a trial. Where used it has been, amazingly enough, highly satisfactory. Whether of the form in which a metal box houses a standard watt-hour meter or where specially designed equipment is installed for direct outside service, there are definite potentialities for this system of measuring the consumption of energy.

The most important advantage of this type of service is the housewife's freedom from the annoyance caused by the entrance of her premises by the meter readers and testers. The best service is always the least obtrusive. A strange complex possesses the minds of some utility men about the virtue of keeping acquainted through genial and friendly metermen who can stop to fix a broken appliance or take orders for new ones or demonstrate this or that. If monthly repair calls are in order, the customer could well mark on the bill when returned with payment that service is needed, or a supply of return postal cards might be furnished for service call requirements. The chief disadvantages urged against the plan seem to rest in the difficulty of maintaining high accuracy and in the discomfort in bad weather to metermen whose duty would keep them out of doors virtually all day. The first objection is nullified by recent progress in temperature compensation. The latter is of no importance whatever unless the customers are to include in their allowance for service the cost of providing heat and space to otherwise badly damaged utility men. It is a company's job to take care of its employees.

It is not necessarily true that either of the devices now used for outdoor metering will prove to be final in point of desirable features, but it is incontestable that the public may some day have fully-annoyance-proofed-service, come how and as it may.

* * * *

Load-Factor Business in Homes

INTENSIFIED service in the homes should be developed on a load-factor basis if the most desirable results are to be had, and rate systems should give inducements to load-factor devices. The habits of home dwellers and the hours of service of appliances cannot be changed greatly, but much may be done to put the use of energy in the home on a load-factor basis through designing appliances to give some degree of heat storage.

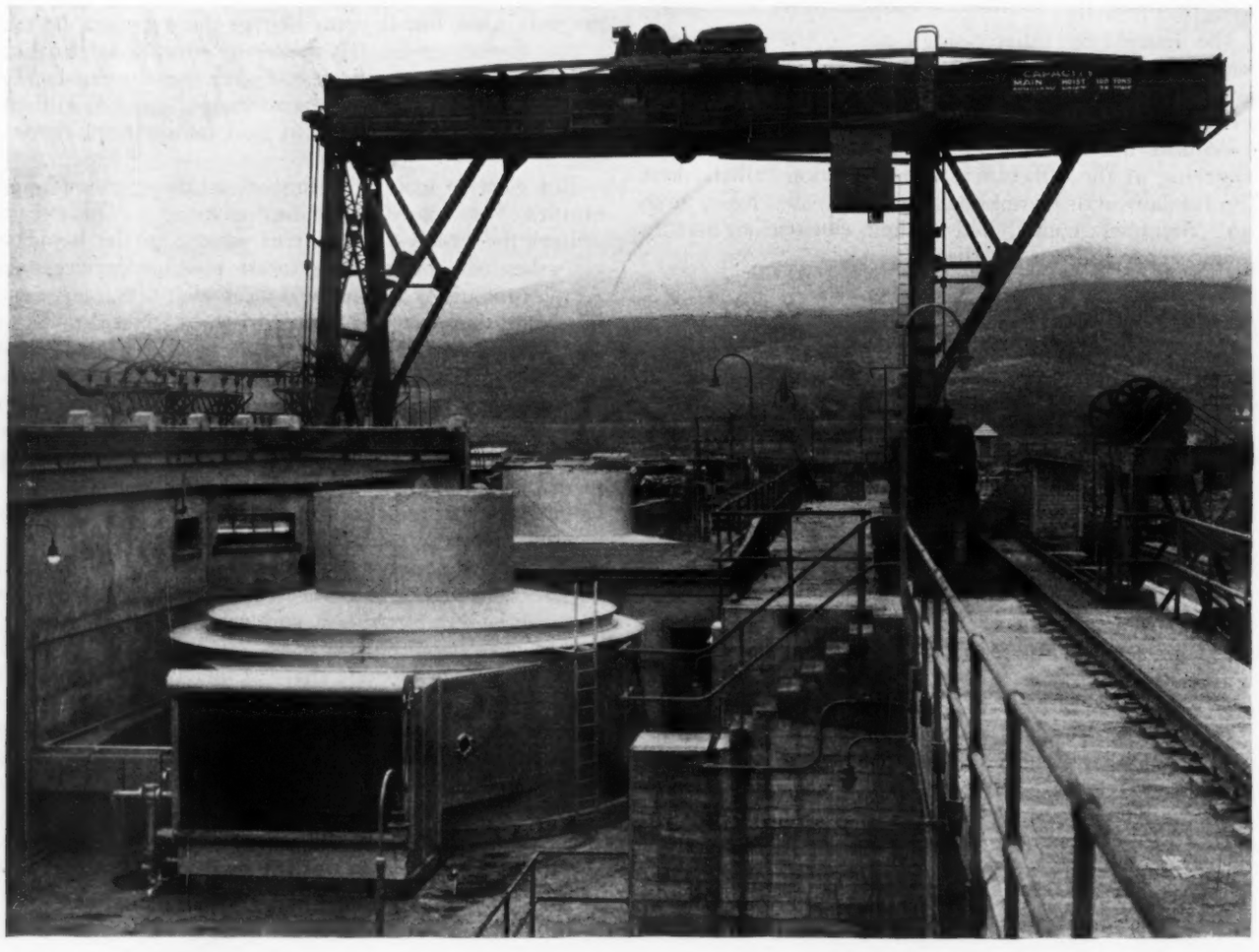
Electric refrigerators have a splendid load factor, but small appliances operate at a very low load factor. From the point of view of energy use only, the range and water heater are the most important home appliances, and fortunately they can be used on a load-factor basis. Cooking habits largely dictate the time at which the range is used, but in some degree the oven can be made a load-factor service. By means of educational work and rate inducements the fireless-cooker element in the well-insulated oven of the electric range can be cultivated to give a fair improvement of load factor in the domestic use of energy.

But electric water heating offers the greatest opportunities for load-factor improvement. This service utilizes the greatest amount of energy in the home and yet gives customers the greatest possible service value. Ample quantities of hot water at all times play a part in making happy and contented homes. Needless to say, the 5,000 kilowatt-hours a year, at a reasonable rate, produces a desirable income for the utility, and a reasonable rate can be provided for this service if water heating can be made a load-factor business or an off-peak business. This can be done by utilizing heat-storage principles either on a high-wattage, off-peak basis or on a low-wattage, continuous basis. Modern water heaters are well-insulated foolproof devices that can be used in conjunction with water heated by fuel-burning furnaces in winter to reduce cold-weather costs, and yet in summer they provide a complete hot-water service at a very reasonable cost.

Field data indicate that properly designed water heaters give a load factor varying from 60 to 80 per cent and can be counted upon to give a diversity with respect to themselves and with respect to ranges that offers one of the highest load-factor services available to utilities. There is no doubt that sales of water heaters will follow a wider recognition of this knowledge, and the domestic service of the future can be looked upon as a high-load-factor business that utilities will attempt to develop to the utmost.

Outdoor Generators for Lewiston Hydro Plant

AN OUTDOOR generating station having a combined concrete and earth dam is situated at the Lewiston, Idaho, hydro-electric plant of the Inland Power & Light Company (subsidiary of the Pacific Power & Light Company). The plant is on the Clearwater River near Lewiston and was placed in operation during the early part of the past year. The concrete dam has a spillway section 925 ft. long equipped with gates designed to spill 50 per cent more water than the greatest flood of record. The earth dam is 7,100 ft. long and serves to flood 640 acres of land for a combination forebay and log pond, the latter being used in connection with a sawmill. The power house is located in the earth dam. Two 6,250-kva. generators are of the outdoor type, protected from the weather by sheet-metal housing. Suitable crane equipment has been provided for handling and dismantling the equipment.

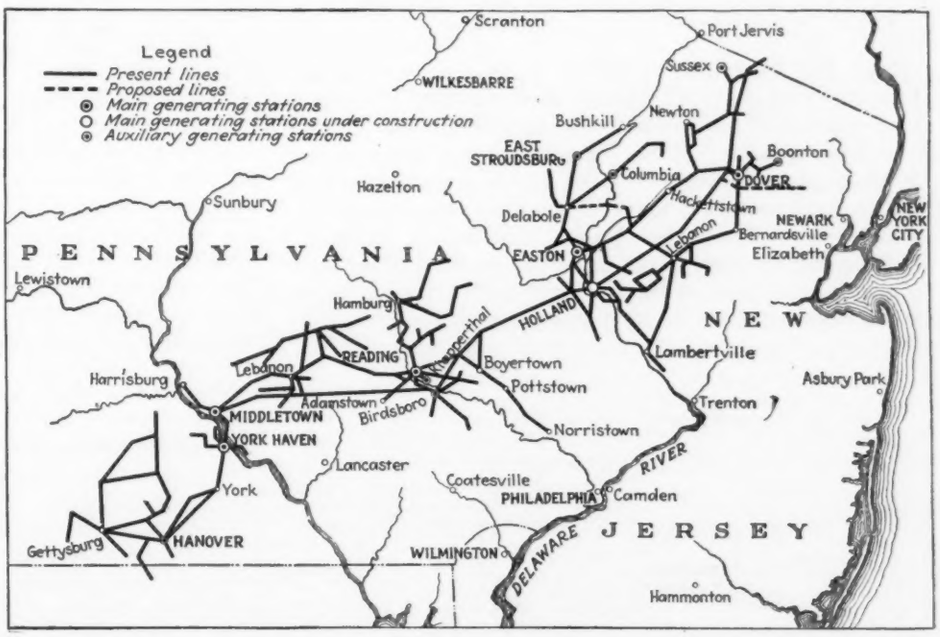


1,200-Lb. Steam for Holland

New generating station of the General Gas & Electric Corporation is designed for variable loads. Economical operation to be secured with low first cost. Furnaces have opposed firing

THE new Holland station of a planned 220,000-kw. ultimate capacity and with an initial unit of 55,000 kw. is being constructed by W. S. Barstow & Company, Inc., at Holland, N. J., on the Delaware River. This station will be the main Eastern generating station of the Pennsylvania-New Jersey power system of the General Gas & Electric Corporation. Three main generating stations, several hydro stations and ample spare capacity in several smaller steam plants provide a power reservoir susceptible to expansion and capable of supplying continuous service on greatly increased demand as well as an interchange of power with the neighboring power systems.

The probelm of creating a generating station which would better the results obtained at Middletown, which is an economical 350-lb. pressure plant receiving coal of the same quality as that which will be used at Holland but located in a lower freight rate zone, led to comparisons of 400-lb. pressure, no reheat, two- and three-stage extraction, with 550 lb. reheat and 1,200 lb. reheat, both with four-stage extraction, according to the engineers of W. S. Barstow & Company. The fourth stage extraction on 400-lb. pressure was not considered economically profitable, and consequently not used in the comparison.



Holland station is tie-in point for Pennsylvania-New Jersey power system

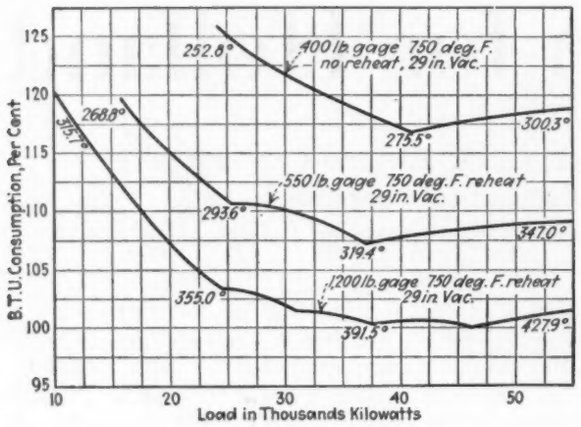
It was first necessary to determine the load factor at which the station would operate and to keep in mind that coal would cost $5 per ton delivered, thus allowing a greater increase in investment per cent betterment in economy than could be justified with coal costing less per B.t.u. The present tendency throughout the country toward complete interconnection of the power stations of a single system, and still further between systems of various companies, makes it less necessary to install spare units as stations are constructed, thus materially reducing the investment required and increasing the active use of the equipment installed.

Detailed estimates on the first cost of the station designed for 400-lb., no-reheat, two- and three-stage extraction and 550-lb. reheat and 1,200-lb. reheat, four-stage extraction were prepared, and from these estimates the fixed charges were determined. When considering the fixed charges plus the production cost it appeared that the 550-lb. pressure reheat plant was less economical than the 400-lb. pressure, no-reheat plant, because the saving in B.t.u. consumption of the former was more than offset by the increase in fixed charges. The 550-lb. plant was also more expensive in both first cost and B.t.u. consumption than the 1,200-lb. plant. This study left but one conclusion, namely, that the station should be designed for either 400-lb. pressure or 1,200-lb. pressure.

With coal costing $5 per ton delivered and a plant with 50,000-kw. turbine units, having a capacity factor of approximately 50 per cent, the 1,200-lb. reheat cycle is the most economical pressure when considering operating cost and fixed charges combined.

Previously all 1,200-lb. installations have been arranged as an increment to an existing, fairly efficient station, thus allowing the high-pressure units to be operated upon base load conditions. In the case of the Holland station, however, where a new high-pressure station was being added to a system having one relatively large and several small hydro stations, as well as interconnections with neighboring systems largely depending upon hydro stations, largely fluctuating load conditions were expected.

Variable load operation was considered throughout the design of the station. A flat steam consumption curve on the high-pressure turbine being desirable, it was suggested to turbine manufacturers that this be obtained by several steam admission valves on the high-pressure machine instead of a single valve such as is used on the 1,200-lb. plants already in operation and turbines having four and five valves were designed. Such machines are now being supplied to all stations of this class now being built.



Comparative economy at several steam pressures

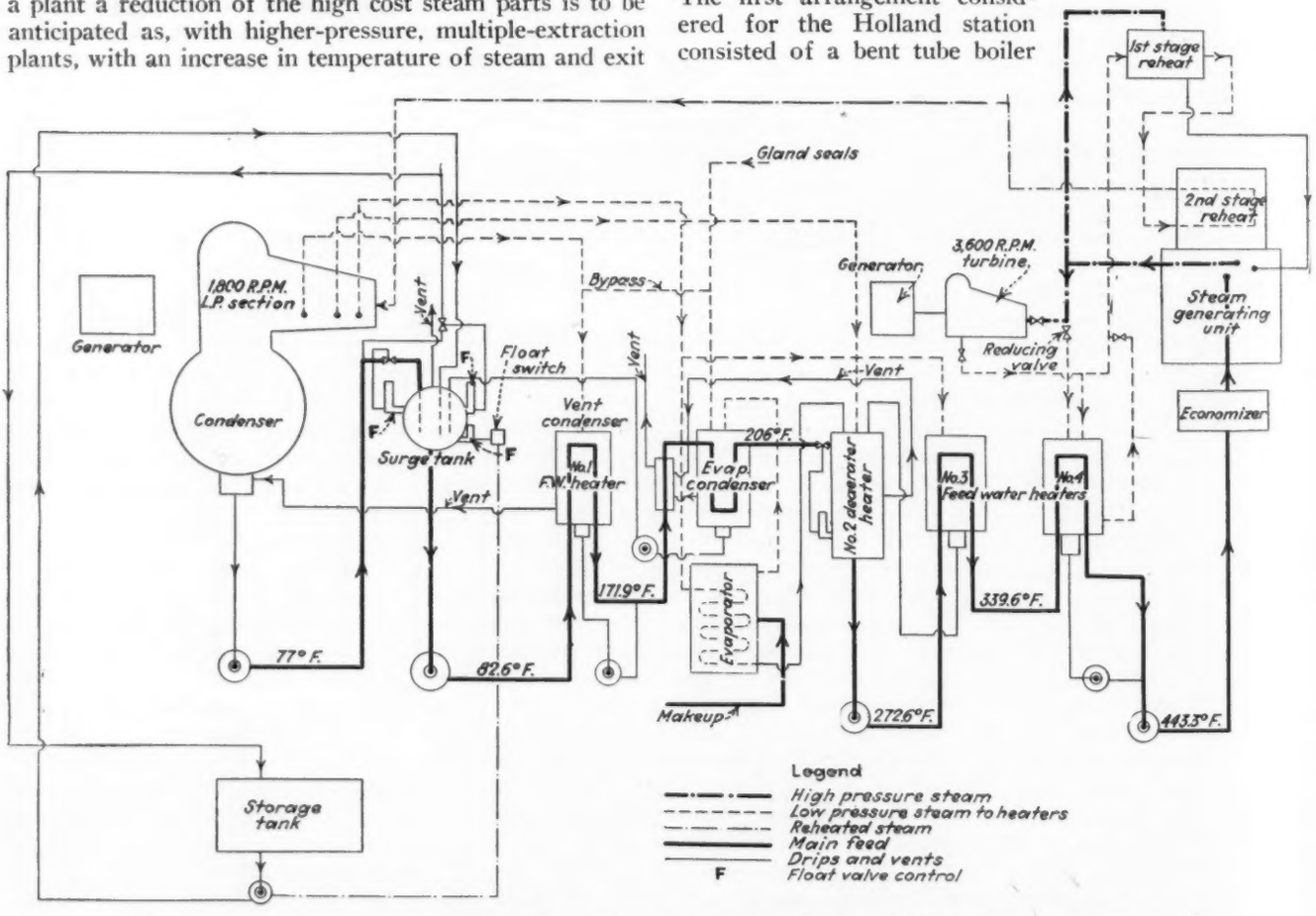
The thermal economies of the 50,000-kw. turbo-generator unit were procured for 400-lb. pressure, no-reheat and 550-lb. and 1,200-lb. single-reheat cycles. These data are expressed in percentage of the B.t.u. consumption using the 1,200-lb. cycle.

The first cost of a 1,200-lb. turbo-generator is but little more per kilowatt capacity than the 400-lb. unit and is cheaper than the 550-lb. compound reheat unit.

A high-pressure station requires careful study of the arrangement and proportion of the heating surface of the steam generating units if the most economical assembly of water walls, boiler, superheater, reheater, economizer, air heater, etc., is to be obtained. For such a plant a reduction of the high cost steam parts is to be anticipated as, with higher-pressure, multiple-extraction plants, with an increase in temperature of steam and exit gases, less of the very high cost boiler surface and more of the less expensive economizer surface is required. With higher feed water temperatures less economizer surface and more air heater surface can be used, the air heater surface being the cheapest surface of all. The proportioning of these surfaces affects the first cost of the station materially.

The use of water walls to reduce furnace maintenance, evaporators, pulverized fuel and many other features governing boiler operation permit almost continuous operation, the outages for cleaning and maintenance covering a small percentage of the time. With a thoroughly interconnected system it is more economical to carry the load dropped during these boiler outages on other plants of the system, or to force the remaining boilers of the plant to a point above normal operation, than to pay fixed charges on the investment necessary for an added spare boiler, so that a high-pressure boiler with its large investment cost takes its place beside the turbine, when considered in relation to the economic installation of spare capacity. For this reason two boiler units per turbine were considered.

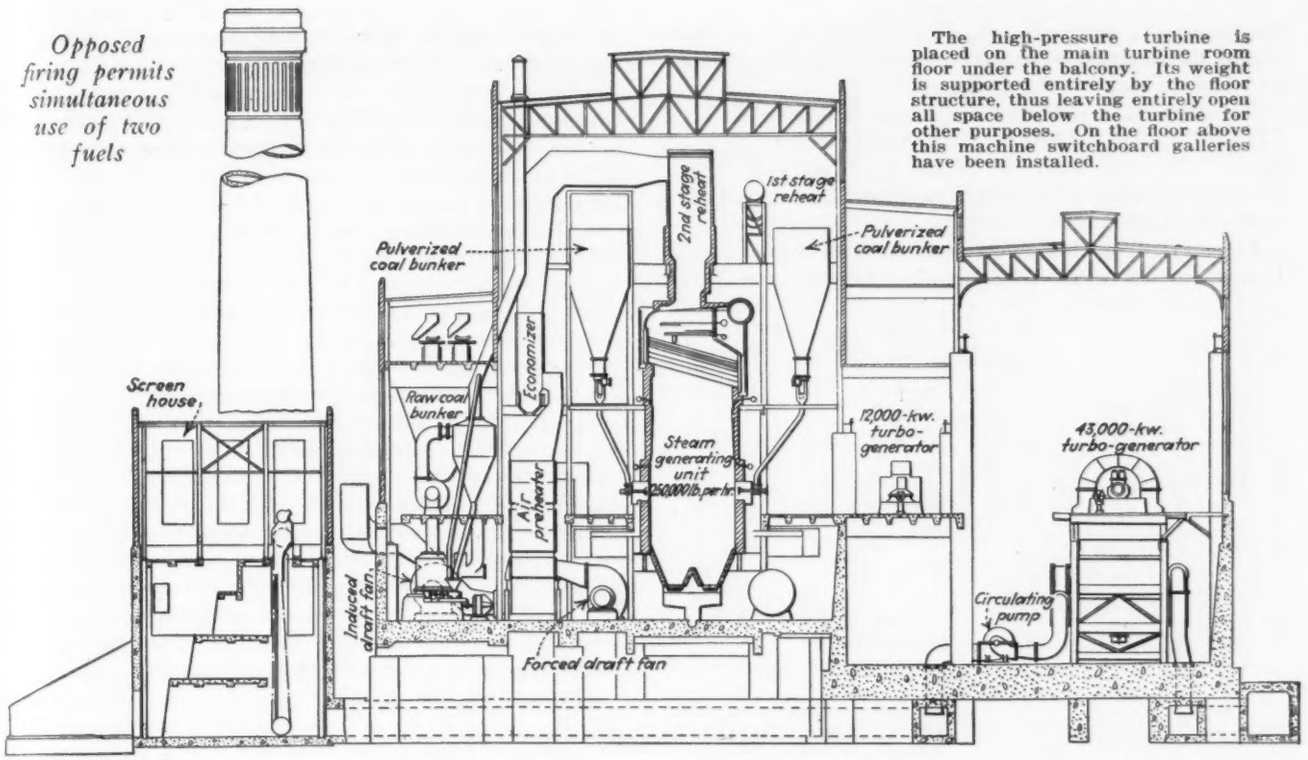
Previously designed plants where reheat has been used have had special reheat boilers which generate less steam than the others and which reheat the steam not only from that boiler but from the others, since with all steam generators built on the same general plan ease of operation would be facilitated and the plant would be crippled considerably less if any one boiler went out of service. The first arrangement considered for the Holland station consisted of a bent tube boiler



Convection type superheater, first stage steam reheater and second stage gas reheater are used

Steam from the boiler flows to the convection superheater and thence to the high-pressure section of the turbine, which exhausts to the steam reheater, operated in series with a flue gas reheater, and is returned to the low-pressure section of the turbine. Saturated steam from the boiler is used in the steam reheater for supplying the heat, and constant reheat temperature is obtained by thermostatic regulation of the steam to the steam reheater, the proportions of the two reheaters being so arranged that at full loads the steam reheater is nearly cut out, the flue gas reheater furnishing all the heat required.

Opposed firing permits simultaneous use of two fuels



The high-pressure turbine is placed on the main turbine room floor under the balcony. Its weight is supported entirely by the floor structure, thus leaving entirely open all space below the turbine for other purposes. On the floor above this machine switchboard galleries have been installed.

with an interdeck convection superheater combined with one of the radiant type and a reheater consisting of a radiant type apparatus located in the side walls of the setting. This arrangement was not entirely satisfactory and after carefully considering possible arrangements of water walls, boiler, superheater, reheater, economizer and air preheaters, taking into consideration the costs and balancing with economies, it was decided to provide water walls, a convection type superheater, a first-stage steam reheater and a second-stage gas reheater, economizer and air preheater, all boilers being built on similar lines.

Comparisons between bent tube and straight tube boilers incline toward the latter type in this case for the following reasons:

In the high-pressure boiler the greatest expense attaches to the drums, and the straight tube boiler with one drum had an advantage in cost.

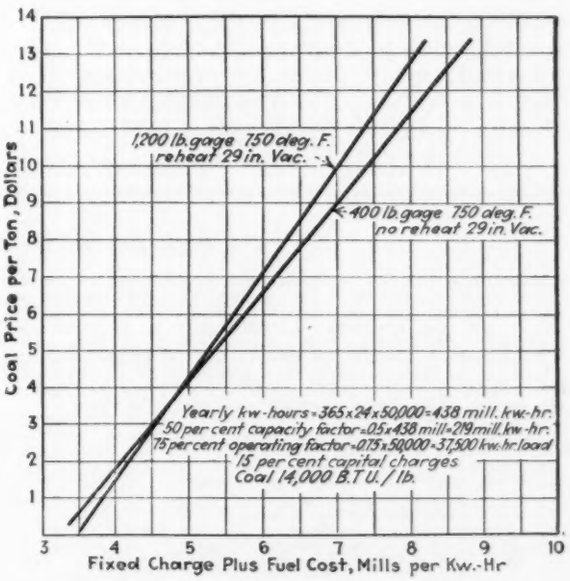
The straight tube boiler allowed a more satisfactory arrangement for the gas reheater, it being difficult to place this between the first and second passes of the bent tube boiler.

The straight tube boiler allows all of the high-priced boiler surface to be located in the highest temperature zone, with the reheater immediately above, and makes the most economical general arrangement of all the heating surface.

The straight tube boiler construction lent itself more economically to space considerations when considering the method of pulverized fuel firing that it was desired to use.

The plant is designed primarily to use bituminous coal, but is so arranged that in emergency part anthracite could be used. The bin system is being installed with mill drying, the vents from the mills being used for secondary air supply to burners. With proper speed control and a careful selection of the proper sized mills there is little difference in the total investment necessary for either bin or direct firing. With the bin system it is possible, without extra cost, to arrange that all fuel be pulverized at night during the off-peak period. This reduces labor costs, increases station load factor and lessens station requirements during peak-load hours. It really adds about 1,000 kw. to the salable peak capacity of the plant and credit can be taken for the investment otherwise required to install this capacity. It also reduces the amount of machinery necessary to operation during peak hours and simplifies operation at a period when this is most desirable.

A further advantage in favor of the bin system was


Coal Price per Ton, Dollars
Fixed Charge Plus Fuel Cost, Mills per Kw.-Hr
1200 lb. gage 750 deg. F. reheat 29 in. Vac.
400 lb. gage 750 deg. F. no reheat 29 in. Vac.
Yearly kw-hours = 365 x 24 x 50000 = 438 mill. kw-hr.
50 per cent capacity factor = 0.5 x 438 mill = 219 mill. kw-hr.
75 per cent operating factor = 0.15 x 50000 = 37,500 kw. hr. load
15 per cent capital charges
Coal 14,000 B.T.U. / lb.

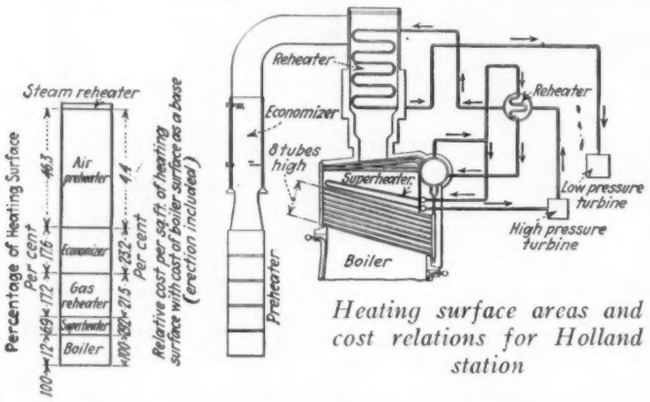
Fixed charge and fuel cost in mills per kilowatt-hour versus coal cost per ton

These curves indicate that the 400-lb. pressure, no-reheat, three-stage extraction cycle is the most economical with coal below $3.50 per ton, and that with coal above this price the 1,200-lb. pressure reheat, four-stage extraction cycle is the most economical. The 55,000-kw. turbine used in the above 550-lb. estimates was the compound unit advised by the manufacturers.

the matter of arrangement, as it was decided to make use of the opposed method of firing with burners located on opposite sides of the furnace.

The furnace is designed for a heat liberation of about 18,000 B.t.u. per cubic foot at 250,000 lb. of steam per hour. The side walls are of the fin tube type, but the two walls equipped with burners consist of bare tubes set in the brickwork.

Opposed firing allows a much better arrangement of burners in respect to the side walls where direct impingement is undesirable and increases the flexibility of operation. It gives great furnace turbulence, improves combustion and reduces the time required to complete the same, thus reducing carbon in fly ash and slagging of boiler tubes. It also enables anthracite and bituminous coals to be fired separately, but to be thoroughly mixed during combustion.



Heating surface areas and cost relations for Holland station

The furnace is equipped with a special water screen above a dry ash pit of new design. The general ash pit arrangement is so laid out that it can be changed to a slag tap bottom if desired at a later period without any major or costly changes.

With four stages of steam extraction employed, the condenser with its piping and auxiliaries may be considerably reduced in size. In this instance only a little over seven-tenths of a square foot of condensing surface per kilowatt capacity of the low-pressure section of the turbine is provided. This corresponds to less than six-tenths of a square foot per kilowatt of total turbine capacity. The condenser is of the single-pass type with horizontally divided water boxes and is arranged for reversing the circulating water flow.

The Holland plant will feed four high-tension and two low-tension (33,000-volt) circuits, tieing all other system generating plants and interconnections together. If all of these lines were out of service at the same time the output of the station would not be needed, and if any one of them was in service it would provide ample power for maintaining auxiliary service. In other words, the station auxiliary system will be backed up by all of the other stations in operation on the system and also by the interconnections with other systems. Therefore, no steam-driven auxiliaries, with the exception of an emergency boiler feed pump, have been provided.

Centralized station control, in which the chief operating engineer is so located that he not only controls the turbines and boilers, with their auxiliaries, but also the ingoing and outgoing circuits, all from one point, was decided upon after careful consideration. This method of operation has been tried and proved eminently satisfactory in a 15,000-kw. plant of a subsidiary company in Florida* which has been operating for over a year now with a total operating force of seven men (three shifts) and a maximum of four repair men.

The wall which usually separates the turbine room and the boiler room will be omitted in order to allow the operators a greater range of vision. While the control equipment will not be made fully automatic at first, provision will be made so that it can be easily changed over to be fully automatic.

The switchboards for the centralized control are to be placed in the high-pressure turbine bay located in the station, where a clear vision of the turbine and boiler room equipment may be obtained with the least obstruction. The electrical equipment, including outgoing feeders, generating apparatus and main feed circuits for the station service power, will be controlled from this point, as well as motors and electrical apparatus vitally necessary for the operation of the boilers and turbine. The space and centralized control requirements do not permit the use of conventional type of power house control switchboard, with the usual arrangement of con-

**See "One-Man Operation for Avon Park Station." by R. D. Stauffer and U. P. Garvin,* ELECTRICAL WORLD, *August 25, 1928, page 349.*

Equipment Features of Holland Station

2 Babcock & Wilcox wrought steel sectional cross-drum boilers, each having an effective heating surface of 7,928 sq.ft.; 1,400 lb. working pressure, equipped with superheaters, designed to superheat steam to a total temperature of 750 deg. F.

2 Babcock & Wilcox convection type reheaters, each having a heating surface of 11,450 sq.ft.; built for a working pressure of 425 lb.

2 Babcock & Wilcox steam-heated type reheaters, each containing 1,508 sq.ft. of heating surface; built for 425 lb. on low-pressure side and 1,400 lb. on high-pressure side.

2 Foster economizer units, each of 11,880 sq.ft. external heating surface.

2 Foster plate type sectional air heater units, each air heater containing 32,450 sq.ft.

2 Sturtevant steel plate induced draft fans, type IV—ID, size 1,006¾.

2 Sturtevant special 115 turbovane forced draft fans equipped with vane control.

1 No. 70 Lehigh air separation type gear-driven pulverizer mill, including one exhaust fan and one cyclone dust collector; capacity 18 tons of coal per hour.

1 Raymond air-swept six-roll supermill equipped with two pneumatic feed controls, one No. 14 exhauster, one 9-ft. collector, one booster vent fan; capacity 19 tons of coal per hour.

12 24-in. Corch adjustable "C" burners.

2 Sets of water screens as described. Boiler No. 1, bottom screen, plain tubes; front, rear and side, fin tubes. Boiler No. 2, front, rear and bottom, plain tubes; side, fin tubes.

2 Ingersoll-Rand No. 5 HST type, six-stage, horizontally split cast-iron casing, centrifugal primary boiler feed pumps, 1,185 g.p.m. at 275 deg. F., 1,750 r.p.m.

2 Ingersoll-Rand No. 5 HT type, five-stage, horizontally split steel-casing centrifugal secondary boiler feed pumps, 1,316 g.p.m. at 440 deg. F., 3,450 r.p.m.

1 General Electric cross-compound turbo-generator unit having a total capacity of 55,000 kw., consisting of an 11,800-kw. at 85 per cent power-factor, 13,880-kva., 13,200-volt high-pressure element operating at 3,600 r.p.m. and a 43,200-kw., 85 per cent power-factor, 50,820-kva., 13,200-volt low-pressure element operating at 1,800 r.p.m. with direct-connected exciter of sufficient capacity to excite both generators.

1 250-kw. General Electric motor-generator set consisting of a KTP 565-6-400-hp., 1,200-r.p.m., 2,300-volt, three-phase, 60-cycle, motor braced for full voltage starting direct connected to a MPC-6-250-kw., 1,200-r.p.m., 250-volt shunt-wound direct-current generator.

2 General Electric generator surface air coolers, total surface for high-pressure generator 5,850 sq.ft., total surface for low-pressure generator 15,600 sq.ft.

1 Ingersoll-Rand single-pass surface condenser, 31,600 sq.ft. tube surface.

1 28-in. D Foster Wheeler two-pass low-pressure closed feed water heater containing 1,576 sq.ft. of heating surface.

1 26-in. D Foster Wheeler two-pass closed low-pressure heater or condenser containing 1,250 sq.ft. of heating surface.

1 28-in. D Foster Wheeler high-pressure feed water heater of vertical "U" bend type, two-pass design, containing 1,486 sq.ft. of heating surface.

1 Wheeler combination high-pressure feed water heater and desuperheater of vertical "U" bend type, containing 1,836 sq.ft. of effective heating surface.

1 Wheeler single-effect horizontal shell-submerged coil evaporator, containing 362 sq.ft. of heating surface.

1 Elliott 450,000 per hour type "J" deaërating heater with 75,000 lb. storage capacity.

trol switches, indicating apparatus and protective relay equipment. In order to compress the number of controls necessary into the space allotted it was decided to install a semi-supervisory type of control. This system will differ from cable supervisory in that no telephone relays will be interposed between control keys and auxiliary relays. In effect, it will be miniature remote control.

The protective relay equipment serving transmission lines, generating equipment and main station service feed circuits will be concentrated on panels at a point convenient to the entrance of the conduit duct run from the outdoor substation, thus minimizing the conduit space required under the turbine room operating floor. Upon this board will be control buttons for use in operating the electrical equipment in emergencies and the auxiliary relay equipment necessary to change the control impulses from the keys at 50 volts direct current to the control circuits at 250 volts direct current. From the relay board to the miniature control board there will be only light circuits in telephone cable. Watt-hour meters will be placed on the relay switchboard, but synchronizing, speed, voltage and current control and indicating instruments will be at the miniature control board.

As the station grows it may be advisable to build the usual separate switchboard room and use special operating men for this purpose. This has been considered and arranged for in the design. Comparison of investment charges show that the installation proposed will cost no more than the regulation layout when the cost of changing to the above future arrangement is considered.

The 114-kv. substation, 33-kv. substation and generator bus structures will be of the outdoor steel-angle frame type. The station service cell structures are to be located on two floors above the high-pressure bay, approximately midway between the turbine room and boiler room. These structures are of the usual type for their respective services.

Station service power is obtained from two sources. The main station service bank is a three-winding type of equipment with 13,200-volt, 2,300-volt and 220-volt windings. This bank is tapped directly off of the general bus through disconnecting switches only. The alternate source of station service power for use during times of shut-down and with sufficient capacity for starting up the plant will be obtained from a third winding in a grounding bank for the 33-kv. system.

Synchronizing on the 114-kv. circuits is to be accomplished by means of condenser bushings in the oil circuit breakers with synchronizing networks, thus saving the cost of potential transformers, since no metering is done at this voltage.

Should trouble occur to the high-pressure turbine, making it desirable to run the plant as a low-pressure plant while repairs were being made, the fourth-stage heater can be used as a desuperheater. This being a condition which it is hoped will occur but seldom, the changing over of the heater from its usual function to a desuperheater has not been arranged automatically, but this can be done should it be desired. Airtight doors, motor-operated with remote control, will be placed directly below the gas reheater, which can be used to throw cold air into the setting at this point, thus preventing the overheating of the reheater should the high-pressure turbine trip out.

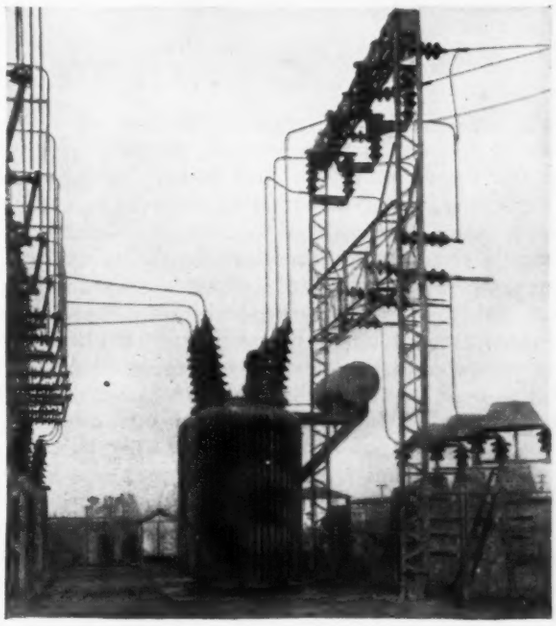
It is expected that the station will go into operation about October, 1929.

Reactors Save Replacing Oil Breakers

By E. R. Stauffacher

Electrical Protection Engineer,
Southern California Edison Company, Los Angeles, Calif.

DUE to the proximity of the State Street substation of the Southern California Edison Company in Long Beach, Calif., to the Long Beach steam plant, the interrupting capacity of the 66-kv. breakers at State Street had been exceeded, necessitating replacement or some means of reducing the short-circuit duty. After considering the cost of installing larger oil circuit breakers as compared with the installation of reactors, it



Reactor which halved short-circuit duty on 66-kv. oil breakers and obviated increasing size

was decided to install one 300-amp., three-phase, 73-kv., 6 per cent reactor in each of the two incoming 66-kv. lines at the State Street substation. The reactors are of the air-core, oil-immersed type, mounted in a steel tank having suitable shielding against magnetic losses and are rated at 2,276 kva. each.

Calculations show that the use of these reactors reduced the short-circuit stresses on the 66-kv. breakers from 800,000 kva. to 480,000 kva., which is well within the interrupting capacity. It was found that the voltage drop across the reactors was not sufficiently great to cause concern due to the fact that the 66-kv. lines are only about 3½ miles in length. The inductive drop of 6.6 per cent at full load was compensated for by changing transformer taps. The energy loss per reactor at 300 amp., or full load, is 41.23 kw., by test, made up of three components. The I^2R loss is 26.7 kw., the eddy current loss 11.1 kw. and the hysteresis loss in the iron shield surrounding the coils 3.4 kw. Since each circuit carries only about 150 amp., these losses are reduced to approximately one-half, or 21.2 kw.

The use of high-voltage reactors appears to offer many possibilities, (1) for reducing short-circuit duty on oil circuit breakers, (2) controlling the transfer of energy between sections of a network, and (3) compensating for

dissimilar characteristics of transmission lines operated in parallel. This piece of equipment is rugged, having only six high-voltage terminals, and can be connected into a transmission line as an integral part of the line without the necessity of switching equipment of any sort. The installation referred to cost approximately $20,000 and effected a saving of about $75,000 over the cost of replacing the oil circuit breakers. In view of their many advantages the Southern California Edison Company is giving consideration to the further use of high-voltage reactors.

High Secondary Power Factor in Series Lighting

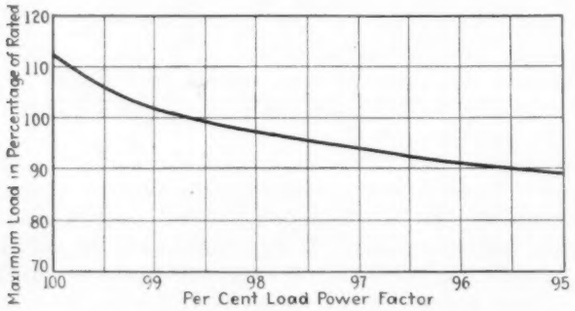
By L. A. S. Wood

Street Lighting Section Head
Westinghouse Electric & Manufacturing Company,
South Bend Works

THERE appear to be some differences of opinion among operating men concerning the primary power factor and the secondary or load power factor of constant current regulators on street-lighting circuits and the following discussion is offered to clarify the situation.

Owing to certain characteristics inherent to the design of moving coil type constant current regulating transformers the primary power factor is not a straight line function of the secondary power factor; neither is the kilowatt capacity of the moving coil regulator a straight line function of the secondary power factor. For example, a 50-kw. station type regulator operating at 96 per cent secondary power factor would only be capable of carrying approximately 47.85 kw. at the regulator terminals, and when carrying the maximum capacity would have approximately 78 per cent primary power factor. This same regulator operating with 99 per cent power factor load would have approximately 51.85 kw. capacity at the regulator terminals and would operate with a primary power factor of approximately 85 per cent at full load.

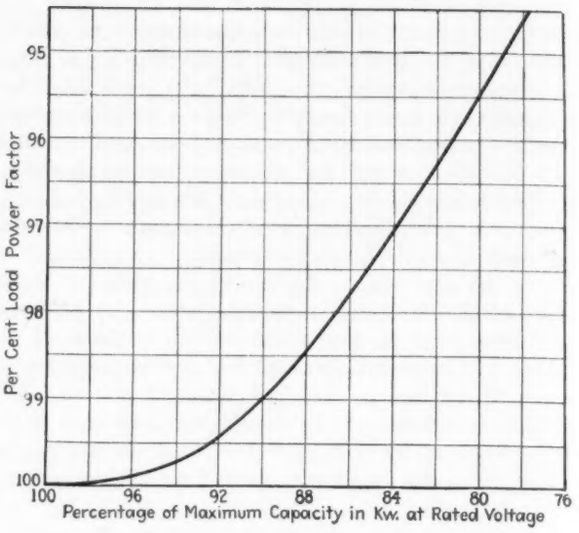
In modern street-lighting practice safety coils and lead-incased, steel-taped cables are often used, and while



Percentage of rated (pole type) regulator capacity available at various secondary power factors

appreciating their advantages some public utility engineers question the desirability of adopting them in the belief that they seriously affect the power factor of the secondary or lamp circuit. The belief that the use of this equipment materially decreases the power factor of the secondary or load circuit is probably due to some confusion of the relation of the primary power factor to the lamp or secondary power factor.

Calculations indicate that the primary full load power factor of safety coils is in excess of 99 per cent for



Capacity available based on maximum capacity of regulator at unity power factor

lamps of 4,000 to 25,000-lumen output. The impedance of lead-incased cable, or even of steel-taped cable, which is somewhat higher, is small compared with the impedance of the secondary load and, therefore, has no tendency materially to reduce the secondary power factor.

The lamp circuit power factor was calculated using the value of the safety coil power factor shown above together with data obtained from tests of lead-incased, steel-taped cable, with the lead and steel shorted and grounded. The results of these calculations indicate that the power factor of series circuits operated with safety coils and lead-incased, steel-taped cable should be in excess of 98 per cent. In order definitely to establish the results obtained from calculations in actual practice tests were conducted on two-series lamp circuits. The secondary circuit of a Westinghouse 50-kw. station type constant current regulator loaded with 6,000-lumen, 20-amp. lamps, rubber-covered cable and individual two-winding transformers or safety coils was tested with the following results:

Secondary Amperes	Load Voltage	Volt-Amperes	Watts	Load Power Factor
6.5	5,850	38,025	37,800	99.4
6.6	6,030	39,798	39,600	99.5

Tests made on the secondary circuit of a Westinghouse 10-kw. pole type constant current regulator supplying power to ornamental street-lighting units equipped with 4,000-lumen, 15-amp. lamps, safety coils and rubber-covered, lead-incased, steel-taped cable showed results as follows:

Secondary Amperes	Load Voltage	Volt-Amperes	Watts	Load Power Factor
6.6	1,300	8,580	8,500	99.0
6.62	1,310	8,672	8,560	98.7

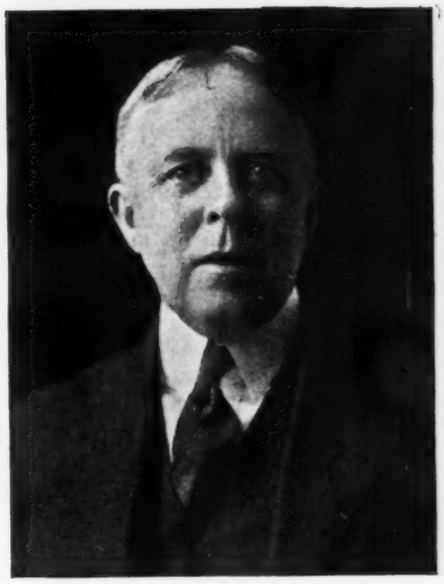
Although these tests do not indicate the exact results to be obtained under all conditions, they show the approximate power factor to be expected. With the results obtained from the test it is felt that the secondary power factor of series circuits of various types will be not less than 98 per cent, except where long circuits of steel-taped cable are used with long spacing between units of low candlepower.

Inducement Rates

*Key to Progress**

Constant reductions in maximum price objectionable. Full use of electricity in home requires low energy prices after overheads are met

By SAMUEL FERGUSON
President Hartford Electric Light Company



Samuel Ferguson

THE vital question to housewives, as I see it, must be how to obtain such greater amount of service from the public utility companies as will result in a higher standard of living and a greater amount of home comforts without exceeding the total permissible family budget. This objective is by no means synonymous with a lowering of the maximum price. So long as the desired results are confused with the maximum price, so long will we get nowhere. If the price to those customers who wish to use liberally is loaded down with paying for the losses incurred by reason of serving at too low a price those who wish only to use a little light, naturally the price to those who wish to make liberal use will be higher than is justified by the cost of their service alone.

This confusion exists today everywhere in the country, and for this reason: The public wants the comfort in the home of the many electric aids that exist today, but it cannot afford their use because of the prevailing prices of electricity. The public feels that the utilities should be able to give the greater service which is needed at sufficiently lower unit prices, so that liberal use will not result in a prohibitive bill, and it knows that the utilities generally are not so doing. A fallacious but most natural inference follows:

You would say, "If a utility can supply all the electricity needed in a fully electrified house at 2 or 3 cents a kilowatt-hour (which price I could afford to pay), and if that utility insists on charging two or three times this amount, the answer is that the utility is profiteering." This conclusion is also supported by the fact that the market value of that utility stock has been increasing to a very material degree the past two or three years.

Consequently, the apparent though not the real solution is to strike at the utility's earnings as excessive, and the only thing to hit seems to be the maximum rate for domestic electricity. The utility is placed on the defensive and produces evidence to prove, or try to prove, that its earnings are not unreasonable, and that therefore you should not be so unkind as to object to its rates, and no matter how the rate case ends, you are the loser.

It may look like a victory to have the commission and courts decide against the company and compel a reduction, say, from 7 to 5 cents per kilowatt-hour, but I ask you if even then you are any nearer to your objective? There are only a few homes that can afford electric cooking, refrigeration and hot water at the reduced price of 5 cents any better than they could before, and owing to the fact that the company's earnings are greatly reduced by your victory, it has no great enthusiasm about giving you the 2-cent or 3-cent energy which you so badly need in your home. Such is, in reality, a step backward, and makes it almost impossible for the company to give you what you need and desire.

The extra energy required for full home electrification beyond what you now use costs very little and can be supplied at a low cost, approximately 2 cents per kilowatt-hour, provided the utility does not load upon the shoulders of the fully electrified homes the losses incurred in serving at too low a price those who elect to make only a limited use of service.

If the utility is foolish enough to try to sell you this service as though it were a commodity like sugar, and charges enough so as to receive the necessary rental in the price per kilowatt-hour, then the price per kilowatt-hour can of necessity only be reasonable for that customer who uses exactly an average amount, and is excessively high for the customer who wishes to use more than the average, and is below the cost of serving the customer whose use is very limited.

In the case of serving the "limited use" customer, the amount of the loss may be

Frankness is always a characteristic of an address by Samuel Ferguson, whose recent talk on promotional rates before the Worcester League of Women Voters forms the basis of this article.

Mr. Ferguson's criticism of the policy of gradually reducing maximum prices for residential service instead of adopting inducement rates to enable even small customers to enjoy the blessings of complete home electrification by the application of low follow-on prices for energy is a straight-from-the-shoulder exposition. It deserves reading by every power company executive interested in domestic rates.

**From an address before the Worcester League of Women Voters.*

only 40 to 50 cents a month, but in a city such as Worcester this small loss on each, when multiplied by the number of such customers, would amount to at least $200,000. This is the burden which prevents you from enjoying the 2-cent or 3-cent price which you, otherwise, could receive in a fully electrified home.

Many companies, because their earnings are attacked, seek to popularize themselves by lowering this maximum rate instead of introducing a system of charges where the rent of poles, wires, etc., is not mixed up in the commodity charge. This practice is very stupid, but unfortunately very common. It leads nowhere because every time the maximum rate is lowered, the burden of losses from "limited use" customers becomes greater and is passed on to those customers who are trying to make "full use" in their homes. It has, however, the apparent advantage of directly affecting the greatest number of voters, thus enabling the company to pose as a great and beneficent institution and to accept the applause of the public. I know this to be so because I did it myself before I learned that it was a policy which was sure to lead eventually to destruction, as must all economically unsound policies unless they are renounced in time.

Up to seven years ago we in Hartford also tried to sell electric service as a commodity at a fixed price per kilowatt-hour. We also reduced this price as earnings permitted from 10 to 9 cents to 8 to 7½ cents. Fortunately for the public of Hartford came the increased costs due to the war, which forced us to retrace our steps and increase the price to 10 cents. Subsequently, when our costs began to go down again we saw the error of our ways and we left the 10-cent maximum alone and reduced the price very materially, not on the first few kilowatt-hours, but on all additional kilowatt-hours, with the result that today all who wish full electrification in their homes can obtain it for 2 cents per kilowatt-hour. The accompanying bill is a sample of a small house where the housewife enjoys the comfort of full electrification. Note that the rate paid is slightly less than 2 cents per kilowatt-hour for the amount used and that this customer pays the rent for his poles and wires even if by chance he should use no electricity in any month by virtue of the flat charge item of $2.10.

The foolish practice of constantly lowering the maximum price exists also here in Worcester. The local company, instead of making full use possible at 2 or 3 cents per kilowatt-hour (as it could easily do except for making up for the losses incurred in serving "limited use" customers at too low a price) has year by year made these losses greater by reducing the maximum price from 10 cents or higher to 9, 8, 7 and finally 6 cents per kilowatt-hour. At none of these prices can you afford to make full use of electricity in the home and, naturally, you become resentful and restless.

One of your papers tried to help you. It started out to get relief for you and make possible the service which you should have. But its zeal was misdirected in that it also attacked the maximum rate and instituted proceedings before the commission where it won what was apparently a victory, in that the maximum rate was reduced from 7 to 5 cents; but what good will that do you, even when and if the company's appeal is decided in your favor? You cannot afford to pay 5 cents for the power required for full home electrification, and therefore you are not benefited materially; all the victory amounts to is a Christmas present of about 2 cents a day to some 30,000 "limited use" customers who already are a heavy burden on the rest of you who wish to have the blessings of low-priced electricity. This burden is on you, and cannot be forced upon the company because of the fact that it is in equity permitted to earn a reasonable profit, and if losses are incurred on 70 per cent of the customers, the other 30 per cent must make them up. It has been urged that such a present to 70 per cent of the customers is equitable because they are probably poor and need the help. But is such argument sound? It is not, for two reasons:

First—The "limited use" customers are not the poor, but are the wealthy who live in apartment houses and go out for their meals and can afford flesh and blood servants at $75 per month. The poor do their work themselves and are the ones who need the help of the electric servant whose wage is hardly 5 per cent of the amount paid to the other kind.

Second—Even if they were the poor, by what right does the utility or the commission undertake to rule that you who wish to use liberally shall have collected from you in your monthly bill a subsidy to be given to the poor so that they can have light at 2 cents a day less and thereby be enabled to buy an extra loaf of bread each week?

Your charities, good and noble though they be, should not be mixed up in your bill for electric service, and they are so mixed whenever rates are such that 70 per cent of the customers are carried at a loss—made up by the contributions collected from the other 30 per cent.

In Canada, because the price of coal is high to manufacturers, it has been possible for the Hydro Commission to make such large profits from the sale of its water

TO THE HARTFORD ELECTRIC LIGHT COMPANY, DR.

FOR ELECTRIC SERVICE RESIDENTIAL

ENERGY CONSUMED ALL METERS K.W. HRS	FROM 1928	TO 1929	RATE	AMOUNT METER 1ST BLOCK	AMOUNT METER EXCESS @ 1-1/2¢	FLAT RATE	ADJUSTMENTS		CURRENT BILL	PREVIOUS BALANCE UNPAID	TOTAL AMOUNT
1149	NOV 9	DEC 12	3¢	6 00	14 23	2 10		Bills Payable	22 33		
								upon			
								presentation			

MN—MINIMUM PR—PRO-RATA CA—COAL ADJUSTMENT PA—PREVIOUS ADDRESS FB—FINAL BILL

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266 PEARL STREET, Hartford, Conn
Office Hours
8.30 A. M. to 5.00 P. M. Saturdays 1.00 P. M.

BRANCH OFFICES
951 MAIN STREET, East Hartford, Conn
Office Hours
8.30 A. M. to 5.00 P. M. Saturdays 1.00 P. M.
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The consumer whose bill is here reproduced enjoys full electrification for less than 2 cents per kilowatt-hour

power to industries that the losses incurred by dropping the maximum rate for household use to very low figures can be made up from industrial customers instead of from other domestic customers. This is, however, a very special case, and due wholly to the combination of high coal price and the almost unlimited water power of Niagara. In this country, if a utility should try the same method, industries simply would not stand for it, but would manufacture their own power, with the result that the share of the poles and wires now carried by them would have to be carried by others.

The Canadian price of 1¾ cents per kilowatt-hour is most alluring, but it is only lower than our companies can do for customers who want full electric service by the amount of the cost of fuel and taxes which must be paid here and not there, provided that, as in Canada, the burden of losses can be shifted off your backs, either by finding some one else ready to pay them or by preventing their occurrence.

I have sought in vain for some Santa Claus who is willing to assume this burden of losses; and therefore, since I cannot find him, I believe the only solution we can find is to prevent their occurrence. This means that each customer shall pay the whole of his own bill, and the only way to do this is for him to pay the rental for the investment, and for those items of cost which are constant, regardless of the amount of use, in the form of a fixed charge every month, and then pay in addition only a low price for the kilowatt-hours used. With such a system, if you fully electrify your house, and use a lot of energy, the $2, $3 or $4 a month of fixed charge becomes negligible when spread over the large numbers of kilowatt-hours used, but will be sufficient to pay the rent in case no kilowatt-hours at all are used. Under this promotional type of rate it is no uncommon thing for those of our customers in Hartford who desire the full comfort of electricity for cooking, refrigeration, hot water, light and miscellaneous appliances to earn for themselves a rate of approximately 2 cents per kilowatt-hour. They are satisfied and so is the company. I can only regret that the misdirected efforts in your recent campaign for lower prices here in Worcester have resulted not only in no progress toward prices which make the electric home possible, but has actually set you back at least five years.

It sounds easy enough to make up for the 2 cents a day given by your commission to customers already carried at a loss, but when you figure it up on 30,000 such customers, and find that it amounts to $200,000 per year, you cannot help thinking how desirable and how equitable it would have been if, instead of presenting it to those not entitled to it, an effort had been made to apply it to making universal electric servants possible for you by reducing their wages to the more reasonable figure of approximately 2½ cents a kilowatt-hour for the total current required in a fully electrified home.

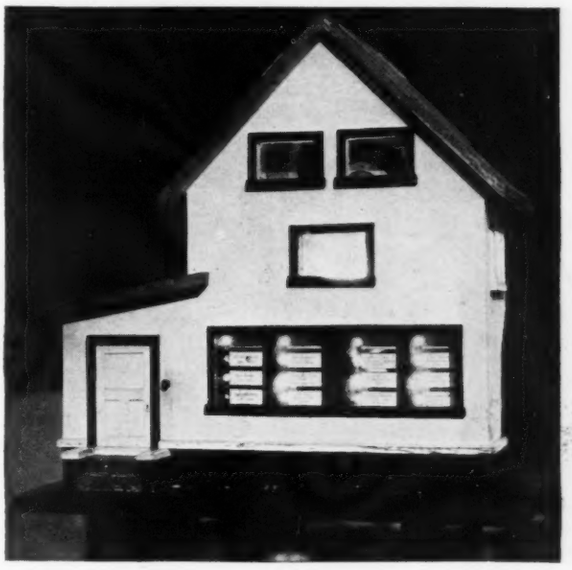
The only way that I can explain the shortsighted action of your Massachusetts commission in applying to the maximum rate the reduction of earnings which it desired the Worcester company to make is the possibility that its hands were tied by unintelligent and obsolete legislation, which directed it to make the reduction in the maximum rate even though its judgment must have directed that the reduction should be made in those places where excessive charges were holding back progress.

Let me, in closing, appeal to your league always to keep in mind the often forgotten fact that it makes no difference how high the price of electricity is for the first few kilowatt-hours, the essential thing is that it be low for all additional kilowatt-hours that you may wish to use. And the more you and every one else pays for the first few kilowatt-hours the less will be the deficit created which has to be made up in the price charged for these essential additional kilowatt-hours. Therefore, the next time you fight, let it be to keep up the maximum rate, and to obtain for yourselves lower prices for the additional use you desire and must have before you can obtain the full service of that most efficient servant in the house—electricity.

Novel Safety Bulletin

By A. F. Lemmon
Safety Supervisor
Blackstone Valley Gas & Electric Company, Pawtucket, R. I.

TO ATTRACT attention to safety matters in a somewhat unusual way, an illuminated bulletin board in the shape of a miniature house was recently built out of scrap material by the substation department of this company in the spare time of the men. The bulletin is mounted on an outdoor platform near the shipping



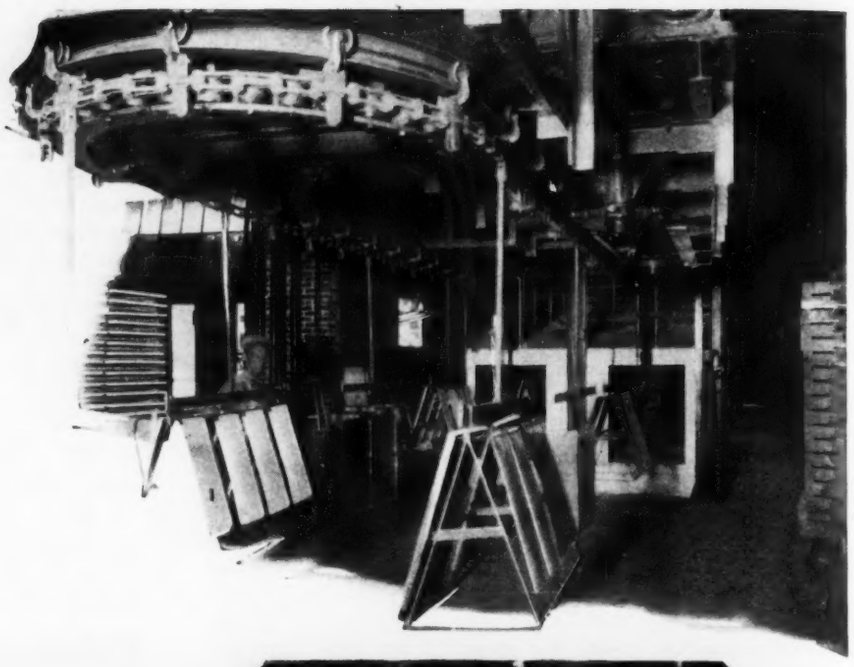
Moving display in miniature house features safety messages

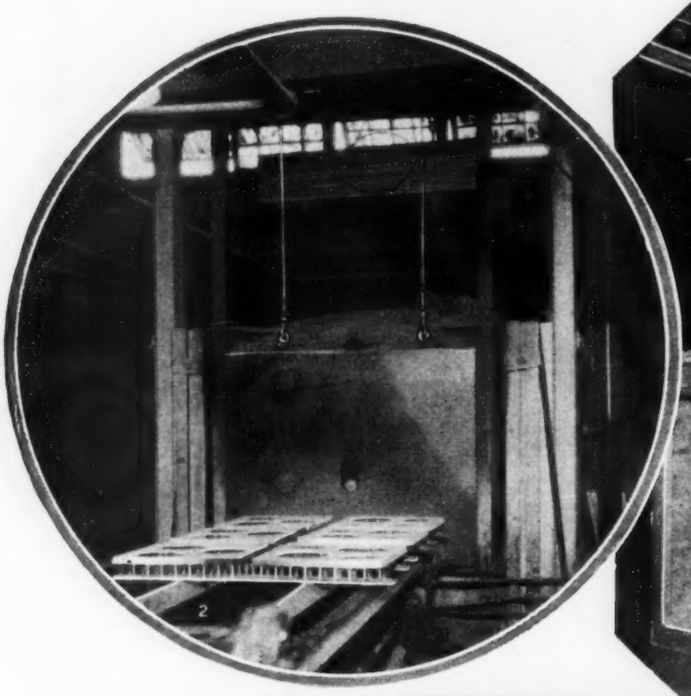
division at the Pawtucket service station, and its main features consist of sets of windows in which are displayed disks and messages which appear according to predetermined sequence upon the pressing of a button at the side of the miniature doorway. The upper windows reveal a revolving colored disk to call attention to the display, the middle window contains a 3-in.x4-in. card display and the lower window contains thirteen spaces representing the different sections of the distribution department.

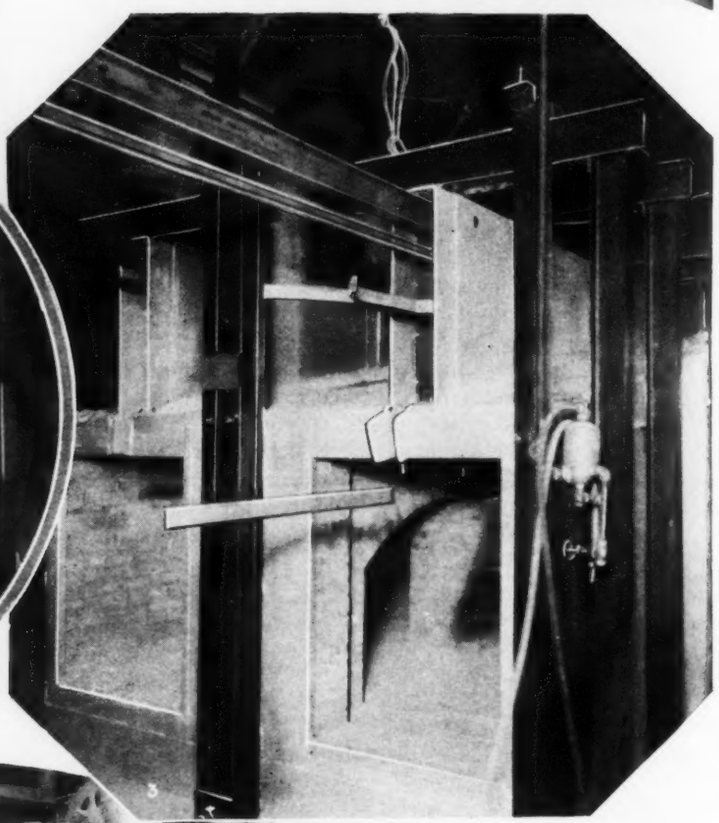
When the button is pushed miniature lamps behind red and green glass buttons above the thirteen departmental sections are energized, crews free from accidents in a stated period being spotted by green lights. The colored disk at the top of the house revolves and the lower disk turns one-twelfth of a revolution, bringing a new message card into view in the middle window. The colored disk stops revolving when the card reaches the reading position, and after an interval the disk resumes rotation and other cards are brought into view until a set of twelve has been exposed.

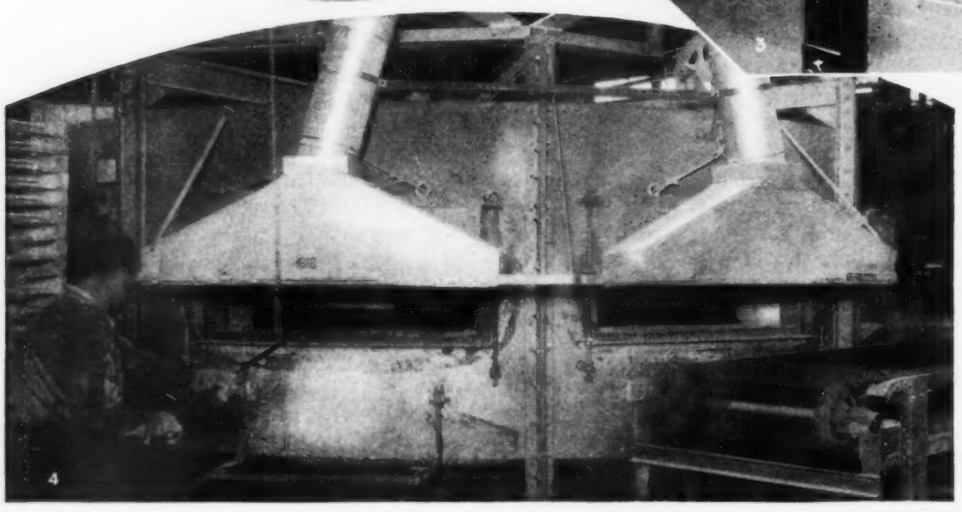
Electric Ranges Enameled in Electric Ovens

THE large number of vitreous enameled parts used on the electric ranges produced by the Edison Electric Appliance Company are all fired in electrically heated ovens. The accompanying illustrations of apparatus in daily use show the progress that only a few short years have seen in the art of baking enamel electrically. Patch type ovens were the first installed, then the rotary and later the return conveyor form.









1. *Conveyor system carrying work into and out of the oven. The entrance and discharge passages are side by side, permitting the incoming charge to be heated up by the outgoing material.*
2. *Batch type 186-kw. oven installed about six years ago.*
3. *Open-end recuperative type oven rated at 570 kw. Material moves through on a loop conveyor, the outgoing work giving up a large part of its heat to the entering material.*
4. *Rotary continuous-process oven rated at 240 kw.*

System Planning in Detroit*

Master plan of system used. Ten-year estimate kept up to date. Rate of system building established by studies. Use of power area principle to establish load conditions

By A. C. MARSHALL and H. A. SNOW

Vice-President and General Manager and Assistant Controller, Respectively, Detroit Edison Company

SYSTEM planning is the general preliminary process of providing for the growth of the system. It should be carefully done, with vision and imagination to foresee and appreciate the future, so as to avoid, if possible, scrapping equipment because of inadequacy before it has served its useful life. A system that grows up without an adequate appreciation of future conditions may reach a stage of development where further expansion cannot be had without tearing down and beginning over again.

The general process of system planning can be divided into two broad divisions, involving, in the first division, the development of a master plan for the arrangement of the system and, in the second division, the determination of the rate at which construction will be undertaken in carrying out that plan. The master plan should be flexible, it should be capable of adaptation to meet shifting conditions and it should provide for almost indefinite expansion. Master plans which do not avoid inherent limitations to the growth of a system, such as the presence of excessive short-circuit currents, the lack of adequate quantities of condensing water, or streets choked with conduit runs, etc., are not suitable. There must be a prearranged solution to such foreseen difficulties, which are bound to arise as the system grows, and investment made in accordance with the plan should remain useful for a normal period of life. It should not be rendered obsolete in a few years because an unexpectedly rapid growth has made necessary a complete rearrangement.

The second division of system planning involves the determination of the rate of expansion, in accordance with the master plan, so as to avoid, on the one hand, the excessive costs of rush jobs and, on the other, burdensome fixed charges on idle equipment. The solution of the problems of the first division of planning tells the engineer what to do and the solution of the problems of the second division tells him when to do it.

TERRITORIAL CONDITIONS INFLUENCE PLAN

The engineer must understand the capacities and characteristics of the equipment which is available to his hand; he must foresee limitations and arrange to avoid them; he must dream of far-flung systems, of enormous power plants, of the standards and habits and methods of life twenty and thirty and fifty years from now. And then he must come back to earth and to the sober realization that additional transformer and cable capacity is needed for next year; to the consideration of just how much and where, and to budgets, time schedules and bills of material.

The Detroit Edison Company serves a territory of about 4,400 square miles, in the heart of which is the city of Detroit. About 80 per cent of the present load is concentrated in the city itself, the remaining 20 per cent is distributed through the suburban territory, with centers of load of varying sizes at each of the nineteen smaller cities and 67 villages served by the company.

The eastern boundary of the territory is made up entirely of major waterways—the Great Lakes and connecting waters and the St. Clair and Detroit Rivers. All along this boundary there is abundant cooling water for condensers, which is most easily available along the banks of the two rivers. Railroad tracks parallel the Detroit River and are accessible at points along the St. Clair River. Foundation conditions are especially good at a few points, and foundations are practicable, if somewhat more expensive, at others. All of the territory served by the company is within reasonable transmission distance of the power plant sites along the rivers. The territory is very flat and there is no appreciable water power available. The master plan calls for steam power generation, the power plants to be located along the Detroit and St. Clair Rivers.

There are four steam power plants in the system. Two are in the city of Detroit, one on the Detroit River, 16 miles south of the center of the city, and one on the St. Clair River, 50 miles northeast of the city. Electricity from these power plants is transmitted to five "power areas" in metropolitan Detroit and to the suburban territory.

The southernmost plant, Trenton Channel, serves the city of Detroit through 120,000-volt transmission lines connecting it with two large step-down substations, Navarre and Warren. The Marysville power plant, on the St. Clair River, is also connected to the city of Detroit by a 120,000-volt transmission terminating in the northeast step-down substation. The city of Detroit has thus five sources of power supply: The Delray power plant, Connors Creek power plant, Navarre transmission substation, fed from Trenton Channel; Warren transmission substation, fed from Trenton Channel, and Northeast transmission substation, fed from Marysville. Other sources of power supply will be added as needed, either by power plants within the city limits or adjacent thereto, or transmission step-down substations fed by power plants at more distant points.

If the five power sources were solidly connected to a transmission network or to a transmission bus some 600,000 kw. of generating capacity might be short-circuited by a cable failure, and this would be 700,000 in a few months. The short-circuit duty on the equipment charged with clearing the fault from the system would be

**Based on address presented to power systems engineering committee, Cleveland, Ohio, January 11, 1929.*

excessive. Equipment designed to handle safely such large short-circuit currents would be very costly. In addition there would be certain difficulties in maintaining voltages at a uniform level throughout the city and in the regulation of voltage under changing loads. Conditions that would be bad under existing loads would become intolerable for a system having twice or three times as much capacity in service. These difficulties constitute a limitation that must be avoided in a master plan, which, under the premises of system planning, must be capable of almost indefinite expansion.

Power Area Principle Used

Accordingly each of the sources of power in the city, as listed above, has been designated as the main feed for a "power area" comprising a group of substations which are fed by 24,000-volt cables from the source of current.

The power plants supplying each power area are operated in synchronism, which is accomplished by means of linkage cables of limited capacity (as compared with the load of a power area) which are equipped with reactors and which link up the buses of adjacent power sources. Each power source, whether it be power plant or transmission step-down substation, is thus connected with its neighbors by linkage cables, except in one case where the tie is made at the Trenton Channel 120,000-volt bus.

In the event of the occurrence of a fault in a power area that is not cleared effectively by the switch on the circuit that has failed, or by the switch on the transmission cable at the power plant or transmission step-down substation, or in the event of a major surge on the transmission system, the linkages between the power sources will open, isolating the power area which is in trouble. The several power areas are so proportioned that under normal conditions the power sources can carry the loads originating in their power areas and do so when separated from the rest of the system. With the linkages open, a power area is cut off from the rest of the system and must work out its own salvation. Certain of the substations in each power area are provided with throw-over feeds so that their service is only momentarily interrupted by the failure of their normal power supply and the crippled area is relieved of their demands for power. The purely industrial substations in each area do not have an alternative feed and they go down when their normal source of power goes down, so that only the most essential part of the load of a crippled area is transferred to adjoining areas. This provision avoids swamping a good area with too much load from the crippled area. Short-circuit currents in the area are effectively limited to those which may come from that part of the total generating capacity which goes with the power area, and power areas are so limited in size that short circuits will be limited to 1,225,000 reactive-kilovolt-amperes which can be safely broken by switches of moderate cost and probably without resort to feeder reactors. The reactors in the linkage serve to limit short-circuit currents which must be broken by the linkage switches.

When conditions in the power area which has been in trouble and which has been cut loose from the rest of the system have been restored to normal the power source for the area is synchronized with the rest of the system by means of synchroscopes in the linkages and the linkage switches are again closed.

The method of connections employed avoids the largest single factor in the obsolescence of electrical equipment, namely, the inability of circuit breakers to clear the short circuits which are continuously increased in magnitude by the growth of the system. The diagram illustrates the manner of connecting together the various power plants and step-down substations by which the Detroit Edison Company hopes to eliminate this excessive obsolescence. A system made up of separate power areas loosely linked together may be expanded indefinitely by introducing more and more power plants into the 24,000-volt cable ring. There is also good reason to feel that with our present instantaneous relaying methods and switch speeds no trouble will occur from instability.

The star-connected reactor bus method is employed in the power houses because it makes all generator units equally available to all others and to the cables without selective switching.

Three Types of Substations

The distributing substations in each power area are of three general types, which we will designate as classes A, B and C.

Residential district substations (class A) are small stations designed to handle a maximum load of typical residential service having a winter-time evening peak lasting about three hours and amounting to not more than 20,000 kva. They consist of from two to four 6,000-kva. outdoor self-cooled transformers, each fed radially by a 9,000-kva., 24,000-volt cable running directly into the transformers without 24,000-volt switching. Each transformer is radially fed where practical from a separate "power area," and in no event are the transformers of a station fed from less than two power areas. Each transformer serves a separate 4,800-volt bus section which is not normally connected to its neighbor, thereby avoiding connections between "power areas." In the initial two-transformer substation each transformer is normally loaded to 4,500 kva., and when one fails the failure of voltage on its bus automatically disconnects it and throws its load onto the other transformer. Each transformer has a short time rating of 9,000 kva. for four hours without injury when the ambient temperature does not exceed 10 deg. C.; that is, under winter conditions. With the addition of the third and fourth transformer, one will be held as a spare and the others loaded to 6,000 to 8,000 kva., depending on the nature of the load. These stations have automatic reclosing equipment on all feeders and are non-attended. The diagram shows a typical class A substation.

Class B switching substations house 24,000-volt switching equipment which is used to transfer load from power area to power area as circumstances may require. They also distribute 4,800-volt power and serve as 24,000-volt feeding points for the residential type substations. Each one is fed at 24,000 volts directly from a source of power (a power house or a transmission step-down substation) and for reserve each is connected by full-capacity 24,000-volt tie lines to the bus of another substation of the same type belonging to another power area or directly to another power house or step-down substation. Thus the entire load of a switching substation with its dependent residential substations may be transferred wholly, or in part, from one power area to another by appropriate switching changes. It is not intended that the switching substations should serve as working connections between power areas, and switches which would, if closed, produce this situation are normally open. The diagram shows several such substations.

The class C industrial type substation is fed directly from a power plant or a transmission step-down substa-

tion without throw-over to another power source. Because interruptions of a second or two will drop the instantaneous low-voltage releases ordinarily employed on motors, it is not advisable to use in these stations the type of automatic throw-over equipment used in class A residence service substations. Accordingly, the substation transformers are connected through star-connected reactors on their 4,800-volt side to a "linkage bus." Each transformer is rated 10,000/15,000/20,000 kva. The 10,000 kva. rating is the continuous self-cooled rating, the 15,000 kva. rating the continuous water-cooled and the 20,000 kva. rating is for eight hours only with excess water cooling. One, and usually two, transformers are fed by two 9,000-kva., 24,000-volt cables and the other

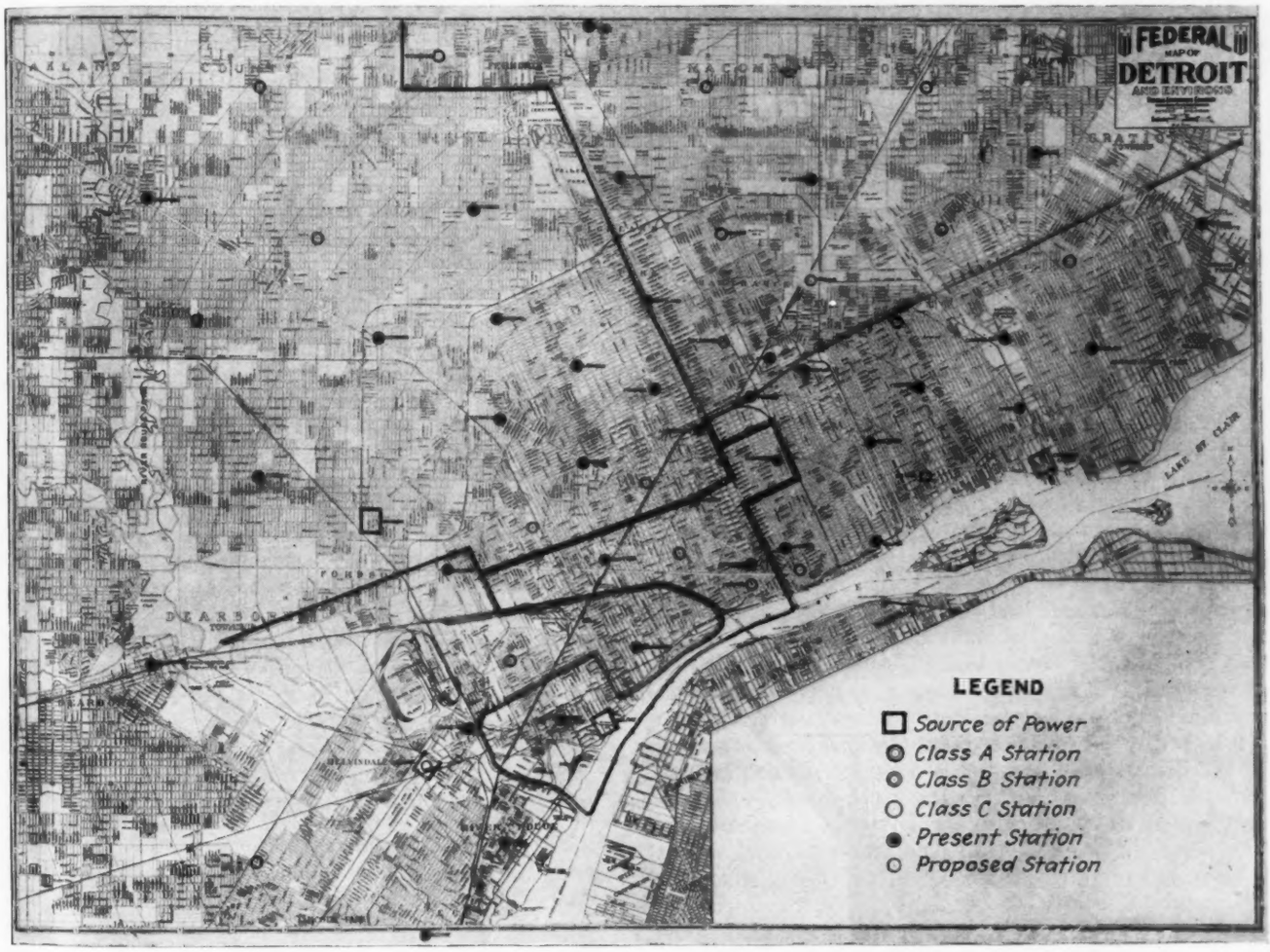


Fig. 1—Electrical layout of the Detroit Edison Company system showing power sources, classes of substations and methods of electrical connection

transformers by one such cable. Thus the remote possibility of two simultaneous 24,000-volt cable faults is guarded against. The transformers which are fed by only a single cable are normally operated self-cooled. Substations of this class are designed for five transformers and have a maximum load carrying capacity of 50,000 kva. The initial installation is usually three transformers. The diagram shows this class of substation. These substations are partially automatic and have only limited attendance. There is no 24,000-volt switching, the transmission cables from the power house running directly to the transformers, and the transformers themselves are placed out of doors.

The company supplies a certain amount of direct-current service in the older downtown territory. Because of the vital importance of the continuity of this service, the substations housing the motor-generator sets are fed from two or three separate power areas and have sufficient capacity to carry their load a short time with the largest feeder out. The direct-current substations are essentially of the class A type, in that each machine is fed separately by a radial cable. Many of the largest buildings in the direct-current area are supplied with alternating current at 4,800 volts through loop cables having both ends connected to substation buses.

An interesting aspect of the general plan is that it does not require duplicate 24,000-volt buses or switching in substations. By connecting the cables from class A (residential) and class C (industrial) substations to separate power house or step-down substation bus sections any one bus section may be lost without dropping other than the normal reserve capacity of the substation. Thus no load is dropped. Another aspect is that the plan reduces to a minimum the number of high-interrupting capacity circuit breakers, which are both high in cost and dangerous when they fail.

This concludes a brief description of the master plan of the Detroit Edison Company for power plants, transmissions and substations in so far as their electrical connections and interconnections are concerned. The location and number of power plants and substations must be carefully planned.

The discussion of power plants has made it clear that they will be as numerous as necessary, with a tendency toward concentration on a rather small number of sites. They will preferably be located on the Detroit River or on the St. Clair River, as near as convenient to their loads. Transmission will be at 24,000 volts or there may be interposed a transmission at 120,000 volts, with a step-down substation at the other end which will be connected into the 24,000-volt "synchronizing ring."

Industrial loads occur in narrow bands of territory along the railroad tracks, but so long as this single condition of location is fulfilled they may occur almost anywhere. In general, such loads are heavily concentrated and may appear or disappear very quickly, say on notice of six months or less. There is no reason why class C substations should not be sprinkled as thickly as desired along the railroads, but a certain amount of change must be anticipated. This suggests outdoor transformers, with industrial type buildings housing the 4,800-volt switches, etc., and perhaps conduit runs roughly paralleling railroad rights-of-way. When an industrial customer's load reaches a demand of about 10,000 kw. it is usually advisable to put step-down transformers on the customer's premises and feed the transformers by 24,000-volt cables from a power house, step-down substation or a class B switching substation, as conditions may dictate.

In Detroit 347 industrial power customers absorb more than half the output of the power houses. Besides being very large the industrial load is difficult to estimate even a year or two in advance and industrial consumption is erratic, following the "business cycles," if such, indeed, exist in these days. We do not know that any ultimate limit may be set to the density per mile of railroad track. The introduction of new processes, such as electrical heat treating, etc., upsets estimates which had previously seemed reasonable.

The downtown district of a great city furnishes another concentrated load, which is more regular in its rate of growth and much more dependable as to location than the industrial power load. The skyscraper district, once established, does not move to a new site without notice. Such auxiliary business centers as may develop in a large city are of minor importance, at least for many years. Occasionally there arises a large and fairly sudden demand for service, such as that occasioned by the installation of air-conditioning equipment in a large department store. Transmission and substation facilities should be provided for in the master plan which will take care of very high load densities in the heart of the downtown district, shading off rapidly at the edges. The exact location of substations is partly determined by the availability of real estate. Continuity of service is of particular importance, and very large reserves of throwover capacity are maintained.

Planning in Residential Areas

With plenty of potential substation sites for industrial service along the railroad tracks, and with the downtown substation sites tucked away in such odd places adjacent to the load as may be obtained, there remains the residential district to consider. Here planning is especially feasible and may be prettily done. Suitable sites are readily available and load densities per square mile may be determined upon with sufficient certainty that they will not be upset as soon as established. The Detroit Edison Company is using a tentative figure of 5,000 kva. per square mile as a limit, which should be good for many years to come. It is only necessary to take a map of the city and arrange the prospective substation sites in any symmetrical pattern that seems to make transmission arrangements simple. A diamond pattern permits the interpolation of additional sites at the centers of the diamonds if densities should exceed expectations. With residential substations (class A) of 20,000 kva. capacity and a density of 5,000 kw. per square mile, one substation would serve 4 square miles, and the distance between adjacent substations would be 2 miles. It will be a long time before this load density will be reached.

The results of such studies crystallized into definitely located substation sites, both present and proposed, are plotted on a map. Such a map permits the purchase of sites well in advance, often at marked savings where land values are rising. It also permits the more intelligent planning of the distribution system, both overhead and underground, particularly when it is considered that this map is based upon load density studies.

The study of prospective substation sites makes necessary some ideas as to densities of load which may be planned for in years to come, and suggests a side line of study which is of considerable importance in system planning. This is the study of the performance, the consumption of current and the load characteristics of apparatus and appliances which are coming into use among customers.

In determining the figure of 5,000 kw. per square mile for a load density to plan for in residence districts, extensive tests were conducted to determine load characteristics and consumptions in actual service of large current-consuming appliances for residence use, such as electric ranges, electric refrigerators and electric-driven oil-burning furnaces, and certain assumptions were made as to the probability of the general adoption of these appliances by residence customers. Similar studies of the load characteristics and consumptions of air-conditioning apparatus, electric brass-melting furnaces, electrically heated japanning ovens, etc., furnish a background for the formation of opinions as to possible future industrial loads to be provided for in the master plan.

Rate of Building Factors

Almost imperceptibly the discussion of system planning has shifted from the first phase, which is the formulation of the master plan itself, to the second phase, which is the making of decisions as to the rate of building power plants, substations and transmission lines in accordance with the plan. The second phase involves the making of estimates of the probable growth of load. Such estimates may, of course, be extended into the future for considerable periods, say ten years or so, and such long-term estimates are interesting as studies and stimulating to the imagination, but there exists no necessity for estimates of future loads that extend farther into the future than the time required to build the plants and procure the equipment which will be required to carry the estimated loads. Power plants must be planned three or four years ahead, substations a year or two, while a year or even less may be sufficient for transmissions.

Each year the Detroit Company prepares a general estimate of conditions for the next ten years, including studies of population, sales of current for the several classes of service, peak loads, output, coal consumption, earnings, expenses, investment in fixed capital and rates charged for service. This study is fundamentally an extrapolation, based on records of past performance,

but modified by established ideas of probable future trends. The several items comprising the general estimate are very carefully correlated with each other to produce a balanced and uniform study.

Use Ratios to Make Estimates

In making the ten-year estimate advantage is taken of the fact that it is easier to form a definite opinion of the probable future values of the ratio between two quantities than it is to estimate the quantities themselves in the abstract. Thus a question as to the total tonnage of coal which will be burned in 1938 meets with only a vague response, while an inquiry as to the probable number of pounds of coal which will be burned per kilowatt-hour of output in 1938 evokes a rather definite opinion. Similarly, ideas of load factors, transmission losses, average wages, cost per ton of coal, kilowatt-hour consumption per customer and customers per thousand of population, which are all ratios, are well established and there is a feeling of confidence in using estimates for such ratios that does not exist when dealing with abstract quantities such as tons of coal, total output, peak loads, total number of customers, etc. Given a single starting point, which must be an abstract quantity, it is possible to develop the entire study by proceeding from item to item through the use of the ratio figures. The fundamental starting point for the ten-year estimate is the estimate of population; this is linked to the number of customers by a ratio, and this again to the total sales of current by ratios, and so on through the entire study. The last or closing factors in the chain are the rates charged for service.

At the end of each year's business actual figures are substituted for the estimates of that year, and in the light of this knowledge and of other ideas and facts that have developed during the year the estimates are reconsidered and revised where necessary and a new year is added, carrying the estimate one year further ahead.

One of the figures developed in the ten-year study is an estimate of the peak load on the system. The first use of the estimate of peak load is in connection with the schedule of additional generating capacity to be installed.

Following the consideration of power plant capacities is a study made of the load on each substation at the time of the system peak. The study is based on the load records taken from the substation meters. After the load on each substation at the time of system peak has been separately estimated, for a period running three years into the future, by extrapolation from the substation meter readings and with corrections for known changes in substation areas, the substation loads for all substations are added together and checked against the estimated system peaks from the ten-year report, less an allowance for transmission losses. There exists a certain diversity between the load on the substations at the time of the system peak and the non-simultaneous individual peak loads on the several substations, and if this difference is important, a proper correction is made, but in general these peaks are used in planning transmissions. The ten-year report is used to unify and correlate the estimates arrived at independently for the several substations and to reveal large errors due to cut-overs and to other abnormal factors affecting substation readings.

The above method for studying future substation loadings is dependent upon extrapolation from past records of peak loads. Past records, say those which are three or four years old, are apt to have been for areas which are different from the areas now served by the several substations because of cutovers of distribution circuits to newly constructed substations. Corrections for cutovers which occurred three or four years ago may be omitted by mistake, and even if remembered, the cutovers are difficult to evaluate. Besides this, the engineer

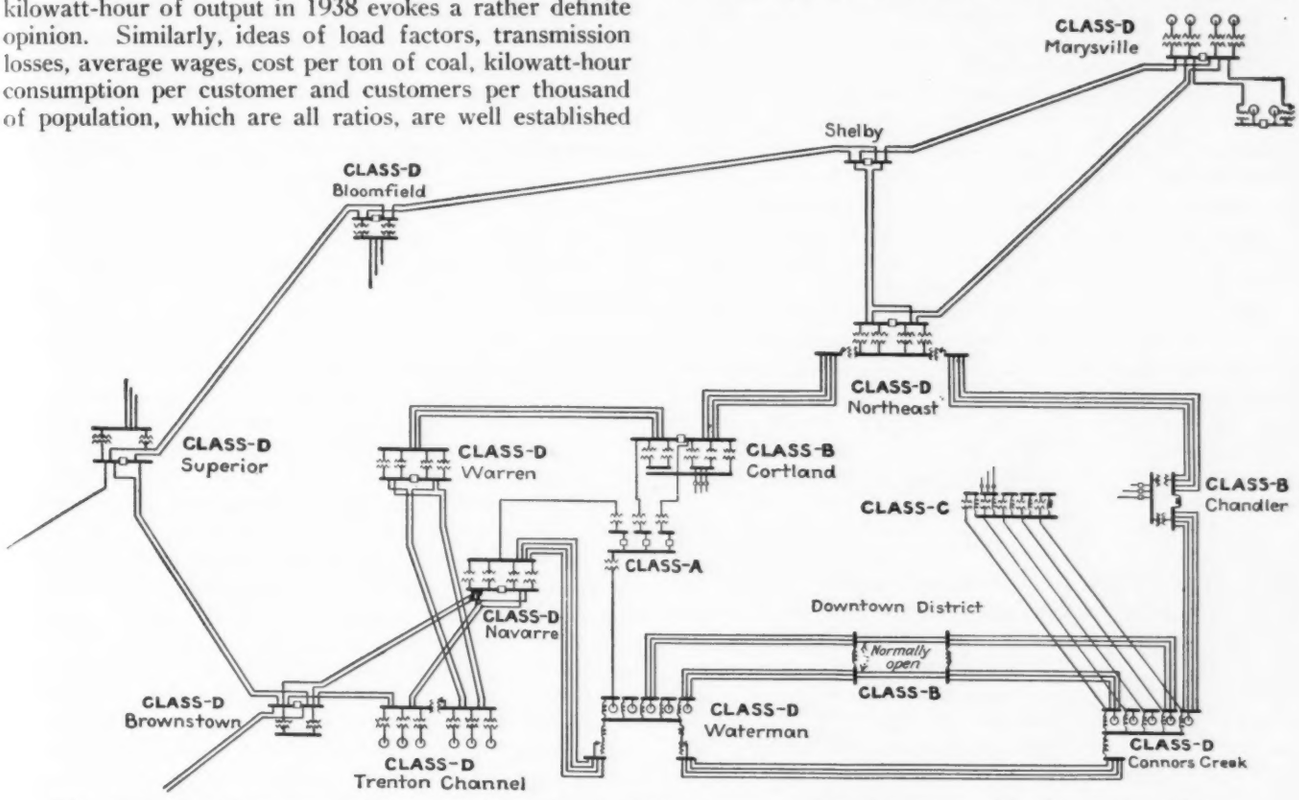


Fig. 2—Substations are built on a diamond principle to serve residential areas. Maximum densities are estimated per square mile and standard rating substations are built

is dealing with peak loads, which are themselves inherently erratic and poor bases for accurate extrapolation. Furthermore, peak loads cannot be added because they are usually non-simultaneous. Substation peak loads are inherently unsatisfactory to work with in estimating the future.

Use of Small Load Area Units

To remedy this unsatisfactory condition the study of the geographical distribution of future loads, for the purpose of planning substation locations and capacities, has been attacked from another angle. The metropolitan area has been divided into some 600 small elements of approximately equal size. In the heavily loaded downtown district the elemental areas are reduced in size to city blocks. These elements are plotted out on the map and assigned consecutive numbers.

The boundaries of the elements are defined by street and number, so that reference may be made to the customers, billing ledgers, which are so indexed, and statements prepared from the ledgers for each small area of the number of customers and of the kilowatt-hour sales. Customers and sales are divided in the usual way into the several classes of service, residential lighting, commercial lighting, small power, etc., so that there is a complete record of the requirements for electric service of each small area. The power requirements are stated in kilowatt-hours, which are not erratic, and which may be added together; at the proper stage in the calculations they are converted to peak-load figures by the use of normal load factors. Abnormal peaks are taken care of by overload and reserve capacity and the planning is done for normal peaks.

A field survey is also made of each elemental area. Note is made of the extent to which the area is built up, of the rate at which building is progressing as evidenced by new buildings under construction, and of the character of the district, whether it be residential, commercial or industrial. If apartment house sand duplexes are beginning to make their appearance this is noted. Factories located in the area are separately studied and by conference with the sales engineers of the Edison company their future needs are individually considered. The general features of the district are recorded, railroads, main thoroughfares, shopping districts, parks, cemeteries, etc. We have never been very successful in selling electricity in cemeteries, though there may be possibilities in floodlighted tombstones. All of the data from the customers' ledgers and from the field survey are concisely recorded and preserved in a file, to be referred to later, when another estimate for the area is to be prepared, so that an idea of the rate of growth and of the character of changes which have occurred since the previous estimate is obtained to assist in making the next estimate.

The next step is to group together the elemental areas which together constitute, or approximately constitute, the territory which is served by the substation under consideration. If the result is not satisfactory, the areas may be regrouped to transfer a part of the area to an adjacent substation. If a new substation is to be built, it is only necessary to add the loads which exist in each of the areas which are to be assigned to the new substation to obtain a very accurate idea of what the switchboard meters in the new substation will read when they are put into commission.

This method possesses a number of advantages. Substations may come and substations may go, but the elemental areas remain as they were; there is no confusion of redistricting. The elemental areas may be grouped and regrouped to study new districts and to determine the effect of proposed cut-overs. A third advantage is that the subdivision of the complex problem of load forecasting into 600 smaller problems does much to eliminate confusing complexity.

Having estimated substation loads (kilowatt and wattless) for the next three or four years to our satisfaction, the next step is to group the substations into "power areas.' The grouping of estimated substation loads gives the estimated loads on the source of power for the next three or four years. If the grouped loads exceed the power or the wattless capacity available from the source the problem becomes interesting. Additional generating capacity may be provided, or substations may be juggled from power area to power area, permanently by rerouting transmissions or temporarily by switching changes in the switching (class B) substations. In extreme cases a power area may be split in two and the foundations of a new power plant started, destined to feed the nascent power area.

At times it becomes desirable to "unload" a power area to permit construction work at the power plant. To a limited extent this may be accomplished by switching changes, but at times it is necessary to install additional transmissions. At other times the power plant men have ideas of their own as to what load they can or cannot carry on certain power plants and they must be consulted before final dispositions are made. They are also inordinately interested in water rates and such like things and upset otherwise satisfactory loading schedules to further their own ends.

The next study is the final test of the plans for the next three or four years, which have been based on the assumption of normal operating conditions; it is the study of emergency conditions, especially at the power plants. Proceeding in rote from plant to plant, the assumption is made, one power plant at a time, that the biggest turbine in the power plant goes out of commission. It is a rule that switching changes shall be possible which will immediately care for such a situation if, indeed, any change at all is needed. Then more complex failures are investigated, various combinations of two turbines down, and then of three turbines down at once.

Project Method for Building

The designs which follow from the study of loads and the decisions as to what additional capacity is called for conform to the master plan. They are incorporated into projects and submitted to the management for executive approval. The collection of approved projects constitutes the construction budget.

To aid the management in the choice of projects for approval, the project sheets are divided into five classes, as follows: Class A, to care for increased load; class B, to increase reliability or safety; class C, to reduce operating costs; class D, to improve appearance of property; class E, miscellaneous.

The budget is the climax of the whole series of studies that began with the consideration of the progress of the art of central-station service and of changes in the habits and methods of living of the people who will be customers of the electric utility ten or twenty years from now, and that terminated in the project sheets for new items to be added to the construction program. Before the project suggested by the engineers is admitted to the budget it must have qualified as being, in the opinion of the management of the company, commercially fea-

sible and advisable. The consideration of general commercial and financial advisability is the last test of the soundness of the proposed project.

Budget the Common Terminus

The budget establishes a convenient common terminus for all the departments of the company, bringing into a centralized group under the eye of the chief executive ideas from the electrical and power plant engineers, the warehouse men, the sales department, with its commercial offices, and its requests for line extensions, and from the meter department, transportation department, general offices, etc. If the company is engaged in other activities besides the generation and sale of electricity, such as gas service, central heating, electric transportation and the like, the requirements for these services should be considered in conjunction with the requirements of the electrical department in order to equalize appropriations and to prevent the most active planners from pre-empting all of the funds.

The budget bureau acts as a continual stimulus to final decisions and to the crystallization of plans that might remain under prolonged discussion or in an undeveloped state for inordinately long periods. There is a rule, which is not always rigidly adhered to when special conditions arise, but which is very effective nevertheless, that a project must be approved for the budget before material may be purchased and men employed, and that the project sheet shall carry an estimate of the total ultimate cost and a time schedule. Furthermore, the budget bureau likes to have its estimates of future cash requirements as accurate as possible and is therefore keen to have the projects submitted and approved at an early date and the cost estimates reasonably accurate. All of this tends toward orderly planning and estimating of costs.

While projects should be approved and added to the budget as early as possible, this cannot, and does not, force the company into rigid and unreasoning adherence to plans which newly arisen circumstances may have rendered inadvisable. The budget itself is flexible and may be changed at any time by adding new projects or deleting old ones. Furthermore, the execution of the projects may be accelerated or retarded as desired. The budget bureau reports to the management that approved plans on file will result in capital expenditures of so much in each month of the next six months or year. If this is not satisfactory the proper executive proceeds to change the plans, and the budget accordingly, and the control department revises the estimates of monthly expenditures. Further than this, the budget bureau of the control department sees to it that, after the executive has approved the plans and turned his attention elsewhere, they are carried out substantially in accordance with his recorded wishes.

New Light on Insulator Behavior

INVESTIGATION into the causes of the peculiar behavior of dirty insulator strings under fog conditions by the Bureau of Power and Light of Los Angeles and one of the universities has shed new light on insulator performance. Persistent complaints of the noise made by a 110-kv. line on foggy nights led to the removal of several insulator strings and a laboratory investigation under conditions simulating actual service.

Tests showed that one unit of a string would dry off more rapidly than the others and begin to discharge heavily over the surface until flashover occurred. The heat produced by the heavy current would then start drying and discharging of another unit in like manner. In the case of the particular 110-kv. insulator strings under test two units would finally dry and serve to insulate against practically the entire voltage, but continue to discharge audibly and thus account for the noise complained of.

In seeking a solution suspension units of the vintage of 1906 and 1907 were tested and, strange to say, these did not perform as do present-day insulators when covered with dust and dirt and operating in the presence of fog. The reason was found apparently to lie in the fact that because of the much smaller pinhole used in the older insulators the high current density immediately surrounding the pin was sufficient to dry all units of the string at about the same rate.

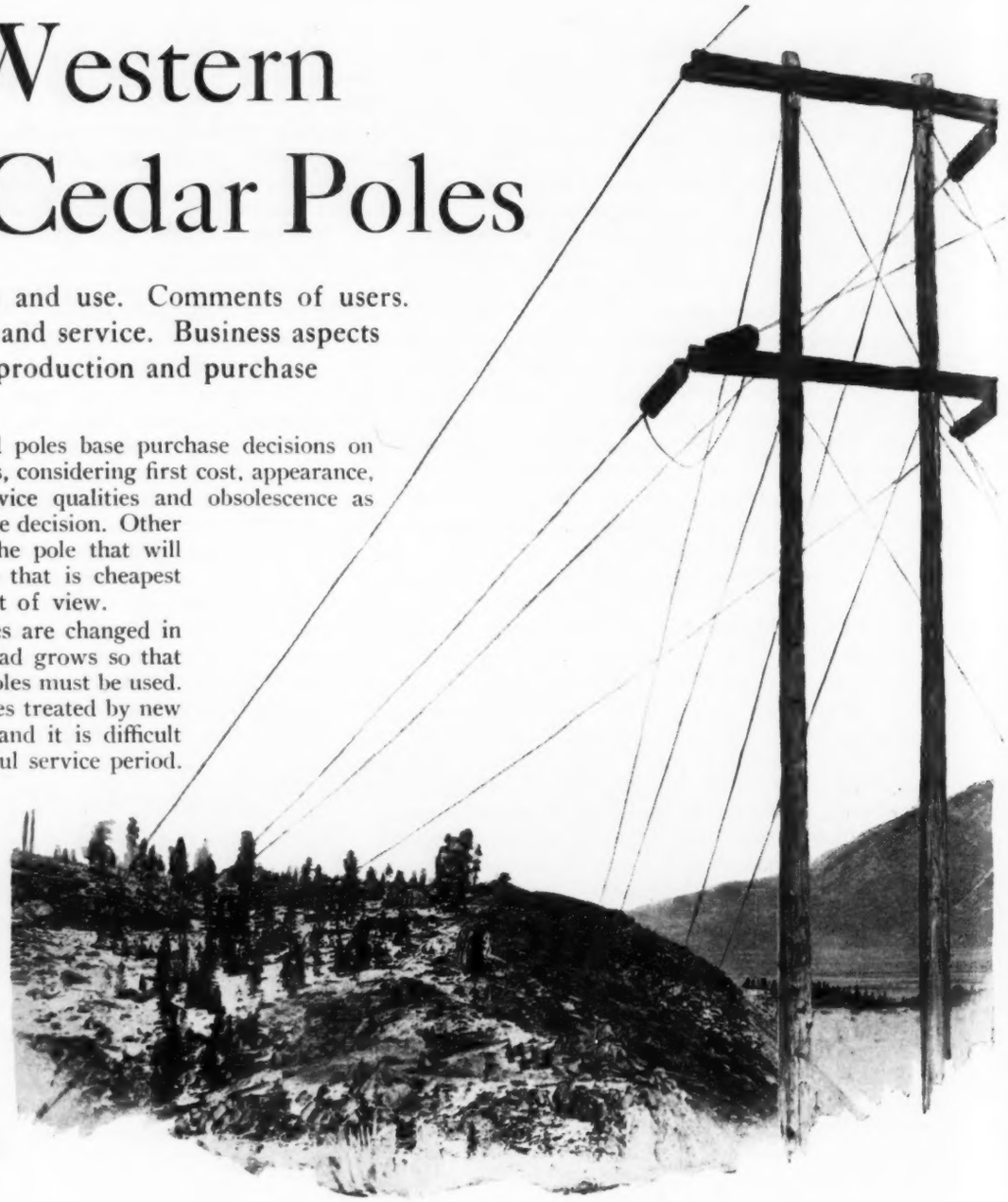
Exhaustive research will continue, but it appears evident from the investigation thus far that the skirts on insulators decrease wind velocity and allow dirt to deposit and that surface shape has an important bearing on electrical performance of insulators. Also, it seems quite probable that some modification in present suspension insulator design may be necessary or desirable for this type of service, according to studies so far.

Huskies Aid Line Patrol in Far North

PATROLLING transmission lines in winter is a man-sized job in any northern country. The 50-mile line between the Great Falls plants of the Manitoba Power Company, Ltd., and the Central Manitoba mines is patrolled by a man with a team of four huskies and a sled. He makes two patrols a week, averaging 25 miles a day. The country is bush, rock and swamp. Severe as the winter patrol may seem, the spring is even worse. During the spring break-up the ground is almost impassable unless one is equipped to walk, swim or fly at a moment's notice, according to John Hurley of the Winnipeg Electric Company. In the spring of 1928 the patrolman was literally marooned at his house 25 miles out, the half-way point of his patrol. An airplane was requisitioned to fly over and drop him provisions to last until the ground admitted of travel. Several times, during emergencies, airplanes have been used to send in repair men and equipment. The dog team hauls a sled carrying equipment to handle any of the routine transmission line troubles.

Western Red Cedar Poles

Pole purchases and use. Comments of users. Data on life and service. Business aspects of pole production and purchase



USERS of wood poles base purchase decisions on the cost of poles, considering first cost, appearance, useful life, service qualities and obsolescence as pertinent factors in the decision. Other things being equal, the pole that will serve best is the one that is cheapest from a life cost point of view.

But many pole lines are changed in a few years or the load grows so that larger and stronger poles must be used. Also, life data on poles treated by new methods are meager and it is difficult to fix upon their useful service period. Again, there is an accounting difficulty, for the utility accountant may depreciate the invested capital in poles more rapidly than the actual poles decay and this may force an economic valuation of a false life basis. Then, again, the service elements in the pole business must be considered. The reliability and promptness of deliveries in the classes of poles used fixes the yard inventory the utility must carry. If poles are bought in the production area directly from woods operators, then a maximum yard inventory must be carried. But if purchases are made from reliable pole companies a minimum yard inventory need be carried. Thus the economic life cost equation must contain many factors that are difficult to evaluate accurately.

Western red cedar is an accepted species of wood for pole use. More than a million poles are used each year by pole purchasers. Some buyers have used this type of pole for many years. Yet actual service data are difficult to get that are applicable to modern conditions. Many of the cedar poles of the early days were "good shippers" but poor poles—the slender poles made a large carload. Modern penetration treatments of the cedar butts are only about eight years old, and the older dip treatments gave uncertain data on life increase due to lack in uniformity in penetration of preservatives. Poles used today conform to very rigid specifications as to physical condition, dimensions at top and butt, taper and butt treatment. The art and the business have so advanced that service experience based on poles of twenty years ago may lead to erroneous conclusions.

Users of Western red cedar poles have had a very satisfactory experience, according to comments received by the author and according to available records. A few cases of center rot were reported and all urge the necessity to get standard N.E.L.A. specification poles. Some general comments of users are as follows:

1. *North Central Utility.*—We use about 3,000 Western red cedar poles a year. Some are bought on contract and others from time to time. We buy A to D class poles with ½-in. "Pentrex" treatment. The strength specifications are controlled by the state utility commission requirements. Average life of poles is 25 years and a specification 35-ft. class B ½-in. treated pole costs us $17.30. We are well satisfied with the cedar poles and with our purchasing experiences with the pole companies.

2. *Eastern Utility.*—We used about 10,000 Western red cedars in 1928 and we will use 20,000 to 25,000 cedars this year. We buy on contracts for 5,000 or 10,000 poles at a time. We buy pole classes from "B" up to "AAA" and specify ½-in. guaranteed "Pentrex"

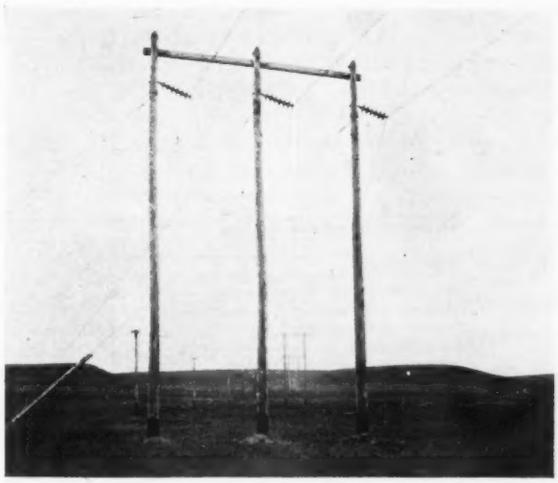
treatment. We use a fiber stress of 5,000 lb. for Western red cedar poles in our line design. We anticipate a life of at least twenty years and possibly 25 years, but have no data. The costs of poles vary with market conditions, but are in line with published prices of pole companies. We have had satisfactory service from Western red cedar poles and find them particularly adapted for use where appearance is particularly important. We have had some cases where the brittleness of a pole has been a disadvantage and we have had a few cases of decay above the ground line, causing the sapwood to drop off. We have had very satisfactory relations with the cedar pole companies and in fact have found them to be quite fair. We base our decision on pole species on their relative estimated annual cost tempered with a great deal of judgment and considering relative advantages and disadvantages.

3. *Northwest Utility.*—We use about 12,000 Western red cedar poles each year. We use fiber stresses in design as given in the National Electrical Safety Code when close figuring is essential. We get eighteen to twenty years life, except in porous soil that hastens decay.

4. *Western Utility.*—We use about 30,000 Western red cedar poles a year and buy the bulk of them on long-time contracts. . . . We specify open tank butt treatment with coal tar creosote and have our own specifications. We buy class poles for joint-use purposes, but use specifications similar to A.T. & T. and N.E.L.A. for most poles purchased. We use the specification of 5,100 for fiber stress, but design few lines on a pole-strength basis. Other factors, such as economic span length, usually govern the design.

Our soil conditions vary and we have had only eight years' experience with butt treatment. Growth of load also causes us to change poles. A life average is rather meaningless to use.

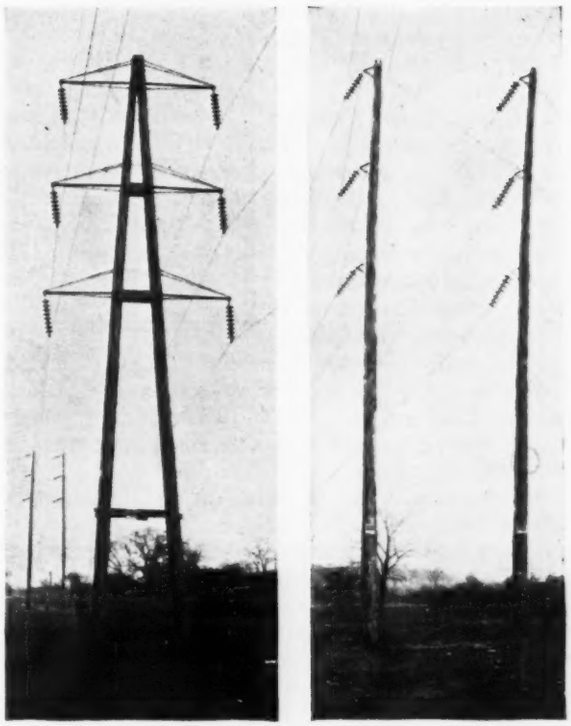
Prices on poles fluctuate with extent of lumber operation in progress, relation of supply and demand, competition in the market and the season. We have had entirely satisfactory service experiences with Western red cedars.



An angle structure on the Montana Power Company System

We buy from a large number of pole dealers near our territory and have had no difficulty in getting poles satisfactory as to quantity and quality. We maintain inspectors on woods operations and on treatment.

5. *Western Utility.*—We use about 12,000 poles each year of Western red cedar. We specify $\frac{3}{8}$-in. penetration



Line structures—100-ft. poles used by the Philadelphia Electric Company

when butt treatment is used and usually season and treat our poles in our own yards and plants. We buy on Western Red Cedar Association specifications plus certain specifications of our own. We buy the following classes:

35-ft. 7-in. top—Woods run
40-ft. 8-in. top—Woods run
45-ft. 8-in. top—Class B

We use 5,100 for fiber stress and the following factors of safety (commission specifications):

Grade A construction 4
Grade B construction 3
Grade C construction $2\frac{1}{2}$

The average life of poles is debatable. Our butt-treated jobs average twenty years. We try to prolong life by (a) proper butt treatment following a thorough seasoning; (b) careful maintenance by cleaning grass from base, etc.; (c) by removing a pole only as a last resort if its physical life is incomplete.

All purchases are made in the open market through competitive bids. Our service experience has been very good and our purchasing experience has been very satisfactory.

Factors to determine what pole to use are: (1) Cost difference; (2) expected life; (3) maintenance cost; (4) fire-resisting properties; (5) right-of-way conditions and cost; (6) importance of line, and (7) various details such as appearance, span, length, clearances.

We estimate twenty years for wood poles and 30 years for steel and balance all elements to fix each important line on a cost basis.

6. *Middle West Utility.*—We use about 7,000 poles each year and buy seasoned Western red cedar on a yearly contract. We buy butt-treated poles with hot and cold creosote treatment of perforated butts. Our standard pole is 35-ft. class B. We estimate the life at 23 years. Price varies with the market and we have very

satisfactory purchasing and servicing experiences. Fixed charges predominate in selection of poles.

7. Middle West Railroad—We get an average of 25 years of life for good butt-treated Western red cedar poles. Our service and purchasing experiences have been very satisfactory.

Many other comments of a like character are available. As will be noted, there are minor differences in specifications and major differences in life estimates. Unanimous agreement exists as to satisfactory service of Western red cedar and as to very good business relations with the pole-selling companies.

> *WE DO well to remember that generally most of us get what we deserve; not that each punishment or each reward is necessarily merited, but that in the long run, on the general average, our ultimate success or our ultimate failure is but the measure of our deserts.*
>
> —P. S. ARKWRIGHT,
> *President Georgia Power Company.*

Some argument has been had as to the strength of Western red cedar. Test of several poles in different places and under different conditions give a range of values from about 5,400 lb. per square inch to 6,400 lb. per square inch for the modulus of rupture. Such tests are subject to errors because of the small number of poles used, the differences to be expected in pole growths in different areas, moisture condition and other seasoning factors. Precision values are not necessary in wood pole line design, although agreement should be had and a standard value established for the modulus of rupture. A value of 5,600 lb. is urged as a standard by the cedar pole companies.

CONCLUSIONS

1. The area in which Western red cedar finds an economic place is large and pole users can count upon a supply of these poles for many years to come.

2. Service experience has been very satisfactory with Western red cedar both as regards the physical quality of the poles and the business aspects of pole purchase.

3. Pole life is a variable. Data on new treatment methods are available only for eight years. They indicate a much greater length of pole life. A reasonable minimum economic life of twenty years may be assured as a sort of national average. In certain locations the life will vary widely from this value for figures show a life of 25 years for untreated cedar.

4. Butt treatment with creosote with the butts perforated will get uniform penetration and will preserve the sapwood at the ground line area for a long period.

5. In the pole production business there are many competitive pole companies. Profit margins are very low and the purchaser has the commercial advantage in the business situation. Competition for business is keen.

6. Reliable pole companies that maintain seasoning and treating yards incur an increment increase in cost to give quick service and to maintain a uniform quality of poles. They have competition between themselves and also compete with wood producers who carry no inventory or treating yards.

7. The competitive conditions in the Western cedar industry make for small margins of profit and indirectly make for wasteful woods operations.

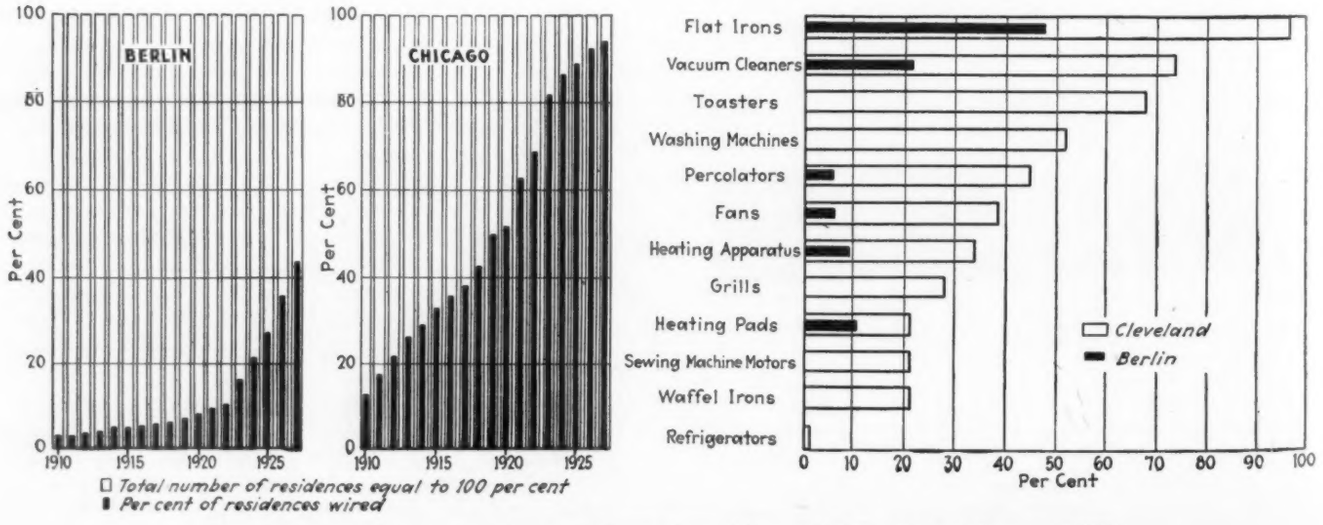
8. Treatment of sound Western red cedar in the ground line area is a justified economic development that has been introduced successfully.

9. There is opportunity for greater agreement in Western red cedar specifications for poles and for treatment. Minor variations in purchase specifications are frequent and treating practices differ for no tangible reason.

10. Research work carried on by the Western Red Cedar Association is a commendable endeavor to improve the poles and the treatment. It should be supported wholeheartedly and be unselfish in its approach.

Germans Use Few Appliances But Increasing

ACCORDING to a recent issue of *Elektrotechnische Zeitschrift* the percentage of wired houses in Berlin is comparatively small compared with the ratio in Chicago, but is increasing at a very high rate. Likewise, the number of household appliances used in Berlin is very small compared with the number in Cleveland. No toasters, washing machines, grills, sewing machine motors, waffle irons or electric refrigerators are used in Berlin and according to the data given there is relatively little use of flatirons, vacuum cleaners, etc.



Development of house wiring and saturation of households with appliances, 1927

A Customer's Experience with Electric House Heating

Home owner relates results obtained with one of the two dozen Fort Wayne homes which are being heated electrically to develop data for more extensive application

By V. M. Nussbaum
V. M. Nussbaum & Company, Fort Wayne, Ind.

CENTRAL-STATION officials, and electrical men generally, have no doubt been watching with considerable interest the recent developments in electrical house heating. My house happens to be one of about two dozen which were equipped with electrical heating plants during the past summer. These houses are all located in Fort Wayne, Ind., and the heating plants were installed by the Hall Electric Heating Company of Philadelphia and Fort Wayne. Some of these homes are large, others are small. Some are new and some are old. Some are insulated, while others are not. Some heat with hot air and some with hot water. They are of different types and construction and, on the whole, may be considered as fairly representative. The results obtained during this first experimental season in these different homes should be highly interesting.

Since I happen to be one of the electrical fraternity and since my new home was one of the first to be equipped for electric heating, it occurred to me that the readers of the Electrical World might be interested in the results secured in my house, which is Colonial in style, brick veneer in construction, with two stories, full basement and attic. It is approximately 40x40 on foundations and has a two-car one-story garage attached. Four-inch studding is used in the outside walls. Johns-Manville insulation board, $\frac{5}{8}$ in. thick, is nailed to each side of the studding. The 4-in. space between these boards is filled with rock wool. There is also 4 in. of rock wool under the attic floor. Double windows are used throughout. The house is, therefore, insulated about as well as modern methods and economy would permit. The heated volume is approximately 28,000 cu.ft.

A hot water heating system is used and it is the only form of heat in the house, except for an occasional wood fire in the living room fireplace.

A 1,600-gal. tank in the basement under the center of the house and inbedded in insulation constitutes the heat reservoir. The water in this tank is heated electrically during the off-peak hours at night to 250 deg. F. A motor-driven pump, controlled by thermostat in the living room, automatically circulates the hot water through the radiators as needed.

We maintain a temperature of 68 deg. through the day and 58 deg. during the sleeping hours. The temperature is uniform throughout the house, and because of the absence of drafts, due to insulation and storm windows, we find 68 deg. a very comfortable temperature. Only ten to fifteen minutes time is needed in the morning to bring the temperature up from 58 deg. to 68 deg.

Our house is located on the edge of town and is isolated and surrounded on north, east and west by open fields, offering no protection from the wintry winds. One morning recently, with a near-zero temperature outside and a strong northwest wind, the house was just as comfortable as in mild weather.

The garage has a large radiator which is connected to the same heating system, but this radiator is turned on only in very severe weather to keep the garage temperature above 30 deg.

The power consumed during the first 30 days, November 28 to December 28, was 6,580 kw.-hr. This included also the domestic hot water heating system, which furnishes hot water to kitchen and bathrooms. A small separate tank is used for this domestic hot water system, but it is heated during the off-peak hours along with the large tank. The rate for this off-peak power is 2 cents for the first 400 kw.-hr. and 1 cent for the balance. The cost was, therefore, as follows:

400 kw.-hr. at 2 cents	$8.00
6,180 kw.-hr. at 1 cent	61.80
Total for December	$69.80

Of course December was a mild month. It averaged about 5 deg. above normal for this locality. Based on these results for December, I expect to get through an entire normal heating season with a power consumption of not to exceed 40,000 kw.-hr. for heat and for hot water. Electric power used for lighting, cooking, refrigeration, etc., is metered separately and is furnished at a higher rate, but it is delivered through the same transformer.

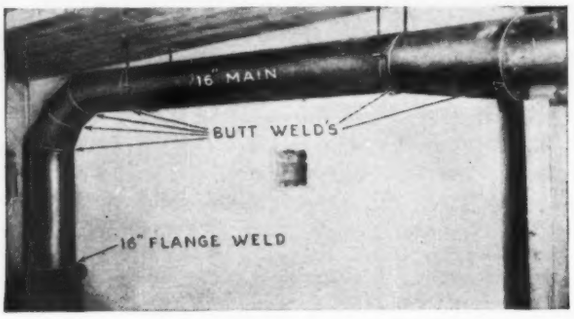
This home required 6,500 kw.-hr. for heating during December

The operation of the heating system is entirely automatic and requires no effort on the part of the householder except the signing of the check at the end of the month.

There is one great advantage of this heating system which is not measurable in dollars and cents. With no flame of any kind in the house, the air remains moist and pure. As a result, our house flowers and plants are in much better condition than during past winters. We therefore expect this feature to be of great benefit to us throughout the winter, and firmly believe that we will experience an unusual freedom from colds and winter sicknesses in our household of six people.

Welded Tees Developed for Pipe Line Construction

ELECTRICALLY welded pipe lines have been utilized in the new building of the Ohio Bell Telephone Company at Cleveland, Ohio. Numerous economies are said to have been realized through the use of this type of construction and have proved satisfactory

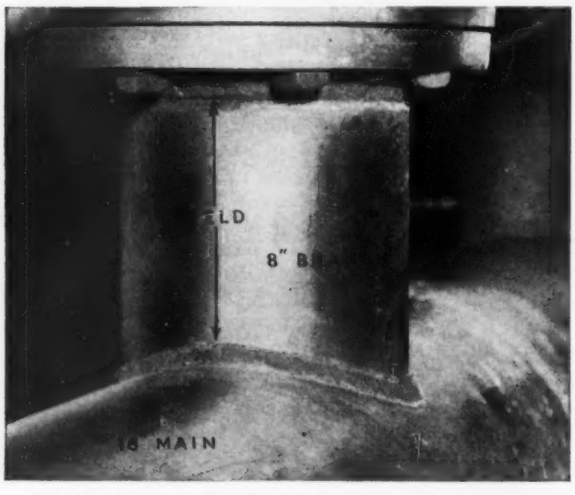


Elbows in pipe line eliminate costly connections

Tack welding precedes the final welding operation and is done while sections are temporarily shored up.

under all conditions, according to A. F. Davis of the Lincoln Electric Company. The main steam riser, a 16-in. pipe, is approximately 250 ft. in length and weighs 17,000 lb. This is anchored by a friction hanger, which is in turn arc welded to the structural steel work. All the joints in the 16-in. main and riser were made by electric arc welding, the sections of pipe being first erected and then butt welded together while in place.

The main header in this building is an illustration of the possibilities of arc welding in eliminating many fittings and simplifying construction. Where tee fittings would have been required for threaded or bolted flange connections the header and main were cut with a torch, the connecting pipe inserted and the joint electrically



Costly tees replaced by arc-welded sections

welded. The elimination of almost all complicated fittings is the biggest item in cost reduction in welding processes. In the case of the Ohio Bell Telephone Company's building the cost of a 12-in.x6-in. cast flange tee for comparable service would have been approximately $35. The total cost, including labor and making a welded connection between a 6-in. flange and a 12-in. flange, averages about $6, so that in this instance the elimination of a single fitting by use of arc welding effected a saving of $29. Lincoln welding equipment was used throughout, the welding being done by Smith & Obi, Cleveland.

Letters from Our Readers

"Dancing Cables"

To the Editor of the ELECTRICAL WORLD:

In the past 35 years I have seen wires dance on only two occasions. One of these was not destructive, due to lack of wind. When I say "dance" I mean jump up and down (sometimes in unity and sometimes not), whip together, trip out breakers and finally burn off.

About twelve years ago, during the night, we had a very high north wind with a very light rain that formed sleet. In the morning the rain stopped, the wind was still north, but not quite as strong, and we were in trouble with trees and wires down. About 10 o'clock that morning I was at one of our substations approximately 700 ft. south of a nine-wire, No. 2/0, 13,200-volt transmission line, running east and west. I could see this line for a distance of about ½ mile (20 poles). All wires, for about five sections, were jumping up and down, and those adjacent to the jumping wires were as tight as fiddle strings. About every minute or so the wires would start dancing at another location a few sections away and the adjacent wires would tighten up. We could not understand it. It was new to us. We had never seen anything like it before. It seemed that every No. 4 soft-drawn bare copper tie wire would have to let go.

Finally, as the wind increased, two of the lines went down and could not be restored until late at night, as the load dispatcher would not take out the third line as long as it was clear and safe. Please note that we had a third line running north and south that was not affected.

When the men went out that night to put up the wires I went with them. The poles are located along the railroad property and about 4 ft. from the railroad wire-line fence. While the men were putting up the wires the foreman and I were deciding just how much of the wire should be cut out due to being pitted. When we came to a point where the wire left the ground I noticed what I considered a very unusual formation of sleet. We decided to inspect five or six more sections to see if we could find the answer to what made the wires dance. All conductors were practically free from ice on the top and bottom, but there was a formation of ice on the north side of the wires of a little less than ½ in. pointing slightly toward the ground. Later we found that the horizontal wires of the railroad company's fence had the same formation of ice, but naturally less of it. A condition of this kind seldom happens.

Take a rubber band or a piece of tape, hold it in a horizontal position with the edges up and blow against it. It will quiver and blow out of line, but when you hold it with the flat side down it will dance. Just how much it will dance depends on how much tension you put on it and how steady and strong you blow. Now, if you have a number of pieces of tape, one above the other, you can easily see what happens.

You will find that electricity has nothing to do with it. A dead line will dance just as much as an energized line.

W. H. CHAMBERLAIN,
District Superintendent.
Public Service Electric & Gas Company,
Newark, N. J.

Digest of Electrical Literature

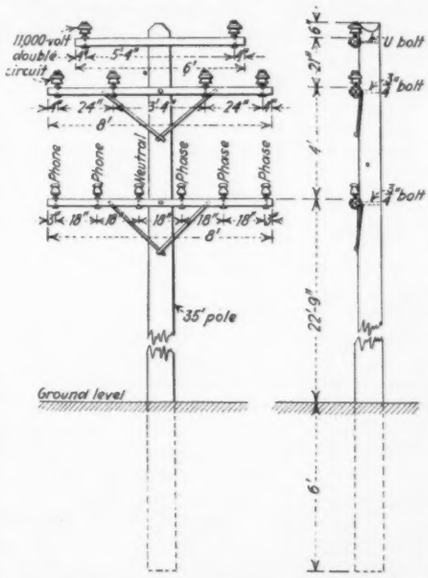
Hydro-Electric Development and Steam Equipment

Intake Grates and Fish Protection.—P. D. LUDIN.—In all European countries the fisheries laws provide that on all low-head hydro-electric plants a fine grating must be installed in the intake to prevent mutilation or killing of fish. In most countries not more than 1-in. clearance is allowed between bars. This has always been considered a hardship from the operators' standpoint, because such narrow grates accumulate a great deal of flotsam, must frequently be cleared and tend in winter to clog with ice. With the advent of modern turbines, particularly those of the propeller type, a mutilation of fish is not to be expected. Tests were made recently in a large Swedish station and it was found that out of 80 fishes introduced at the intake and caught again in nets in the tailrace only two were found cut, and an autopsy of all the others revealed not even internal damages. As a result the Swedish laws were amended to allow the removal of fine grates at all waterwheel installations.—*Elektrotechnische Zeitschrift,* January 10, 1929.

Transmission, Substations and Distribution

Effect of Connection Link in Chain Type Insulators.—G. VIEL.—The theory and the characteristics of chain type high-voltage insulators have been well established, but very little study has been given to the investigation of what influence the length of the metallic link between the chain members has upon the flashover of the complete chain. Tests of this nature have been made chiefly on Hewlett type disks, and it was found that lengthening of the link—that is, an increase of the commonly used link—helps materially to improve the chain. For example, a 120-kv. line was equipped with standard seven-disk chains. It was desired to increase the transmission voltage to 150 kv. Following previous practice, two more disks were planned to be added to each chain, but it was found that by lengthening each link 5 cm. (about 2 in.) the seven-disk chain is satisfactory.—*Revue Générale de l'Electricité,* December 22, 1928.

Rural Lines in New Zealand.—W. P. GAUVAIN.—Rural electrification in New Zealand started on a large scale as the result of the passing of the electric power boards act in 1918. In the majority of cases power is purchased in bulk from the government stations at 11,000 volts. Standard voltages for distribution work are 11,000, 6,600, 3,300 and 415/240 at 50 cycles. In lines operating at 11,000 volts the minimum clearance between any portion of the line and ground is 20 ft. This height is sufficient to allow of a double circuit. Consequently in the majority of cases 35-ft. poles are used. This height is sufficient to allow of a double-circuit 11,000-volt line, with a secondary voltage line on a crossarm at a distance of 4 ft. below the lower 11,000-volt arms. The poles are set 6 ft. in the ground. On the low-voltage arm are usually run three-phase wires, neutral and street lighting wires. The latter in many cases are replaced by telephone wires. Stranded hard drawn copper is chiefly used, while galvanized iron wire and various forms of copper-covered steel wire are used to a small extent, both usually in cases where the loading is small and with but little chance of any increase in demand. All lines operating at 11,000 volts and upward must be bare.



In country districts all lines below this voltage may be bare, but when such lines pass through towns the low-voltage wires must be covered with triple braiding thoroughly impregnated with waterproof compound, while lines above low voltage and up to and including 6,600 volts must be covered with vulcanized rubber of at least 600 megohm grade.—*Electrician (England),* January 25, 1929.

Generation, Control, Switching and Protection

Thirty Years of Oil Switch Development.—G. BENISCHKE.—In spite of very prolific theoretical and practical research, carried on for 30 years, the oil switch is still the most vulnerable part of a high-voltage system. Oil piston theory, high-pressure arc extinguishing, explosion chamber construction, multibreaks and other plausible sounding developments could not prevent many recent damages to apparatus and human life caused by internal explosions of oil gases. The oil piston theory has been largely sustained by tests on glass models, which the author does not believe valid, since an extrapolation of such results to large breakers is not permissible. Creating a high pressure around the arc in an attempt to extinguish it quickly gives the hot gases less time to cool off and may lead to mechanical destruction. A quick break can be better accomplished by either a mechanically produced jet of oil or by a powerful magnetic blow field. High-speed contact opening may become detrimental since it may prevent the relatively sluggish oil from entering between the contacts quickly enough. Multi-breaks have proved effective, more so than any other method, but such breakers are much wider, because the individual breaks must be far enough separated to prevent being bridged by the arc.—*Elektrotechnik und Maschinenbau,* December 20, 1928.

Units, Measurements and Instruments

Short-Circuit-Proof Current Transformers.—W. REICHE.—The paper presents a theoretical investigation of short-circuit forces in a current transformer and their results. It is shown what magnitude the dynamic forces may assume, tending to mechanically destroy the windings or the core structure, and what dangers are brought about by excessive heating. The requirements for an all-around safe current transformer are: Immovable windings, solid fastening of leads, plenty of copper cross section, absence of compound or oil and low stray flux. It is claimed that only the recently developed one-piece porcelain type of current transformer fulfills all of these five points.—*Elektrotechnische Zeitschrift,* December 6, 1928.

New Remote Position Indicator.—H. LOHMANN and C. SIEBER.—The readings on pressure or vacuum gages, water level indicators, Pitot type instruments or any other meter with an appreciable torque can be transmitted to any desired distance with great accuracy by this new principle. A small glass tube is bent into a closed circle of about 3 in. diameter. One-half of this glass tube contains a spiral of fine wire, made of platinum alloy, the ends of which are fused through the tube. The other half of the ring contains mercury. If this ring tube is arranged to rotate on a horizontal axis it is obvious that if all of the internal spiral is out of the mercury it will represent a maximum of ohmic resistance, while it will be all short-circuited if the ring is turned, submerging the spiral completely in the mercury. The axis of the ring tube is attached to the gage and a direct reading ohmmeter is connected at any distance to the ends of the spiral. A cross-coil instrument was found best suitable as an indicator. If the distance

between sender and receiver is great complete temperature compensation can be obtained by a three-wire connection. Voltage variations of up to plus minus 10 per cent do not affect correct indication. — *Siemens Zeitschrift*, December, 1928.

Theory of the Induction Type Watt-Hour Meter (III).—N. KATO.—A calculation of the mean torque acting on the rotating disk of induction type watt-hour meters is given under the following assumptions: The disk is extremely thin; the magnetic flux is known and confined under the magnetic pole, elsewhere it is zero; the magnetic pole is a circle and the magnetic induction is uniform within it, but the voltage and current flux distributions are overlapping. The result of this calculation is compared with the result in a previous paper issued in 1925 under the assumption that the voltage and current distribution are not overlapping. — *Journal of the Institute of Electrical Engineers of Japan*, December, 1928.

Illumination

Development in Airway and Airport Lighting. — R. W. COST. — The rapid progress of the last few years in aviation has introduced a new field of work for illuminating engineers quite different from that of the past, namely, the lighting of airports and airways so that they can be used 24 hours a day. A description of the essential requirements of the equipment that must be used and conditions that must be avoided for this sort of lighting.—*Journal of the Western Society of Engineers*, January, 1929.

Lighting the Great Hall of Sydney University.—The Great Hall of Sydney University is considered to be one of the architectural gems of the world's universities. It was built about 70 years ago and its artificial illumination until recently has been far from adequate. Ten hexagonal bronze lanterns of Gothic design, in keeping with the archiecture of the building, inclosing Holophane prismatic glass reflectors with 500-watt Mazda lamps, have been installed. Also, in each lamp are three 41 vacuum lamps to illuminate the side panels and canopies. Each lighting unit or lantern is wired for a separate circuit to the distributing board with individual fuses.—*Electrical Engineer (Australia)*, December 15, 1928.

Motors and Control

The Design of Armatures for Small Direct-Current Motors.—A. F. PUCHSTEIN.—To obtain the correct relative proportions of copper and iron is an important consideration in fixing the dimensions of an armature. The designer who examines the accessible literature on this problem will find numerous curves, tables and other data. If he looks further he will find that the published material is intended for sizes over 5 kw., and when he applies it to fractional horsepower machines the preliminary results will be absurd and the work will require considerable revision. A description of an outline of some methods believed to be useful for fixing the preliminary dimensions of small armatures from the point of view of efficiency and with greater precision than those heretofore in use.—*Ohio State University Studies, Bulletin No. 42.*

Speed-Current Characteristics Determine Settings for Time Interlocks.—L. C. HARDESTY.—On a current-limit mine-hoist control equipment the current-limit relays are set to operate at a certain current, usually about 125 per cent of motor full-load current, depending upon the load condition. On each step of acceleration after the current has fallen to this value the current limit relay will operate and cut out a section of resistance in the motor circuit. With time-limit control equipment it is desired to obtain the same operating characteristics as described for the current-limit equipment, assuming the same load conditions. With time-limit control the time required for all of the accelerating contactors to close when the master switch has been thrown to the last running point is dependent upon the time adjustment for the geared interlock.—*Coal Age*, February, 1929.

Electrophysics, Electrochemistry and Batteries

Hydrogen Ions are the Key to Corrosion.—A. A. MARKSON and PAUL FRITZ.—The control of corrosion is now a major problem with most power plants. As to what causes it even the doctors disagree, which has led to confusion among the engineers. The discussion proves chemically that the presence of hydroxyl ions in water causes corrosion. A method of testing for the presence of these ions and correction are given.—*Power*, February 5, 1929.

The Development of the Oxide-Coated Filament.—B. HODGSON, L. S. HARTLEY and O. S. PRATT.—A review of the development of the oxide-coated filament and a description in rough outline of present-day methods of manufacture for commercial purposes, which indicates the most recent views on the mechanism of electron emission from alkaline earth oxides.—*Report of the Institution of Electrical Engineers* (England), February, 1929.

Sound Recording with the Light Valve. — DONALD MACKENZIE. — The light valve developed by Bell Telephone Laboratories is an electromagnetic shutter consisting of a loop of duralumin tape formed into a slit at right angles to a magnetic field. Sound currents from the microphone and amplifier flow in this loop, causing it to open and close in accordance with the current variations. The slit is focussed by a lens on the sound negative film. An incandescent ribbon filament is focussed on the light valve and the light passed by the undisturbed slit appears on the film as a line at right angles to the direction of the film travel. As the valve aperture is modulated by sound current, the film receives a varying exposure and a sound record of the variable density type is obtained. For talking pictures such a sound film is made on a separate recording machine synchronized with the camera and is printed alongside the picture on the finished positive. The prints are displaced so that the sound is advanced over the corresponding picture. This is in order that the sound may be projected at a point of continuous film motion below the picture gate.—*Bell System Technical Journal*, January, 1929.

Traction

The Development of Turbo-Locomotives.—VICTOR P. DOLENGO-KOZEROVSKY.—Never in the history of the American and European railroads have railway mechanical engineers been so active in endeavoring to improve the efficiency of public power units as at present. In Europe, where the majority of the developments have taken place, this is explained by a tremendous surplus of locomotives on railroads and a bad economic situation which makes imperative the conservation of expensive fuel. The general trend is in the four following directions, ranking according to the efforts made and the sums spent: Improvements of piston locomotives which are perhaps immediately more fruitful and, therefore, more practical; Diesel and turbine locomotives, so far closely rivaling one another; gas and oil engines, and electric locomotives.—*Mechanical Engineering*, February, 1929.

Miscellaneous

Great Northern Tunnel Through Cascades.—FREDERICK MEARS.—The economic considerations which prompted the construction of the tunnel were: Permanent protection from snowslides over six miles of snowsheds eliminated; the operating costs for snow removal eliminated; shortening of lines by 7.68 miles; elimination of 940 deg. of curvature and the rise and fall of all trains reduced 501 ft. Detailed description of surveys, method of construction, the elimination of water nuisance and construction of tunnel.—*The Military Engineer*, January-February, 1929.

Electricity's Important Rôle in the West's First Underwater Vehicular Tube. — ROMAINE W. MYERS. — The Oakland to Alameda underwater vehicular tube uses electrical power for traffic control, lighting, ventilation and other electrical features are described. In order to insure continuity of service three 4,000-volt, three-phase, four-wire feeders have been installed. Low-speed motors are used to drive the ventilating fans. Three kinds of traffic signals direct traffic, the usual red and green and the special signal designated as a "stop engine" signal for emergencies. Vapor-proof reflectors with 100-watt lamps are spaced opposite each other at 20-ft. intervals, giving an average intensity of between 14 and 20 ft.-candles. Two separate circuits feed the lighting units. —*Electrical West*, January 1, 1929.

News of the Industry

Congressman Morin Has New Shoals Bill

Eleventh-Hour Measure Would Turn Plants Over to Agricultural Department—Senator Norris Tells How the Regulator Is Regulated

By Paul Wooton
Washington Correspondent for the Electrical World

POINTING out that "no court could relieve the government from a foolish or unwise contract directed by Congress itself relative to the disposition of public property," Chairman Morin of the committee on military affairs of the House of Representatives urges Congress, in a minority report, not to approve the Muscle Shoals offer of the American Cyanamid Company. Instead of the proposed lease Chairman Morin proposes that the government's properties at Muscle Shoals be turned over to the Department of Agriculture with authority to experiment in the manufacture of nitrates for use in war and as a fertilizer. After reserving sufficient power for the experiments the remainder of the power should be disposed of so as to secure the maximum return to the government. Mr. Morin submitted the text of a bill intended to carry out such a plan and carrying an initial appropriation of $2,000,000. Chairman Morin, while severe on the whole measure, was particularly caustic in his criticism of the recapture clause of the bill approved by a majority of his committee.

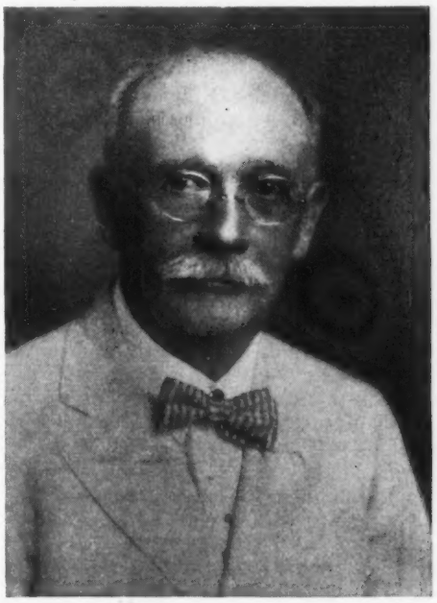
Senator Norris reviewed on the floor of the Senate on February 26 a letter written by Leon Bradley to Thomas W. Martin dealing with the former's publicity activities. This letter was put into evidence and discussed at a Federal Trade Commission hearing a month ago. A statement made in the letter to the effect that publicity matter dealing with power was being sent to members of the Public Service Commission as well as to newspapers led Senator Norris to observe that this shows "how the power companies regulate the regulator." He expressed the opinion that the state commissions "intend undoubtedly in a majority of cases to do what is right between the utilities and the people, but they are faced daily, not only with propaganda prepared by the power trust, but with the ablest experts and the ablest attorneys that money can secure, while the public sometimes is not represented at all and often is represented in a very inferior way. Is it any wonder, under that kind of pressure, that finally the power trust will be able to handle the commissions, even without the commissions knowing that they are being handled and controlled? The personnel of the commissions is human. They start out with a fair-minded view, but they wind up after a while with a viewpoint of the power trust."

The two houses of Congress have approved an extension to March 5, 1930, of the resolution restricting the Federal Power Commission from issuing or approving permits or licenses affecting the Colorado River or any of its tributaries except the Gila, and the President is expected to sign the bill. This action was necessary because of the fact that the limitation placed in the Boulder Dam act will become effective only with its ratification by six of the states affected.

The national water-power policy committee of the Chamber of Commerce met in Washington on February 27, February 28 and March 1 to discuss further the recommendations which it expects to make.

Weston Fellowship in Electrochemistry Established

Dr. Edward Weston, electrochemist and engineer of international reputation, has established the Edward Weston fellowship with the American Electrochemical Society by means of a donation of $25,000. The candidate will be selected by the society and selection will be based on marked capacity in carrying out research in the science of electrochemistry or its applications. The award will be made without distinction on account of sex, citizenship, race or residence. The successful candidate may carry out his research at any university or institute approved by the society. The date of the first award (approximately $1,000) is not definitely fixed, but it will probably be in the fall of this year.



Edward Weston

Dr. Weston was born in England May 9, 1850, and there studied medicine. He came to the United States in 1870, entering the employ of the American Nickel Plating Company. He is responsible for many improvements in the nickel-plating art. At that time the electroplating industry was very much hampered by the lack of low-voltage generators, and Dr. Weston set about to invent several new types of dynamo-electric machines and established in Newark in 1875 the first factory in America devoted exclusively to that class of machine. In 1881 his plant was consolidated with the United States Electric Lighting Company, of which Dr. Weston was electrical engineer till 1888.

In 1888 he formed a new company, the Weston Electrical Instrument Company, of Waverly Park, Newark, N. J., for the main purpose of manufacturing the Weston electrical instruments—voltmeters, ammeters and others. He has been president of this company for many years. The well-known Weston cadmium cell is the fundamental volt standard throughout the world. The fact that Dr. Weston developed a system of incandescent electric lighting is often overlooked today. The filament of the lamp was a material which he called "tamadine," a product of his genius as a chemist. He has been the recipient of many honors and awards.

Zimmermann Takes Presidency of U. G. I.

Various rumors regarding the presidency of the United Gas Improvement Company of Philadelphia were set at rest on Wednesday of this week when John E. Zimmermann, who became chairman of the executive committee with "temporary full executive powers" in December, was elected president by the board of directors. Mr. Zimmermann succeeds Arthur W. Thompson, to whom a six months' leave of absence was granted early in December and whose resignation was accepted last month. Mr. Zimmermann will continue to hold the executive committee chairmanship, and Samuel T. Bodine, a former president of the company, will remain as chairman of the board of directors.

Mr. Zimmermann became identified with the company in 1927 when United Gas absorbed the engineering and construction firm of Day & Zimmermann. He is chairman of the executive com-

mittee and of the board of directors of the Philadelphia Electric Company and chairman of the boards of the Susquehanna Power Company and the Philadelphia Suburban Counties Gas & Electric Company. He is on the directorate of numerous other companies and banking institutions. He is 55 years old.

Santa Fe Conference Still at Sixes and Sevens

Argument over the Colorado River and the Boulder Dam has gone on for another week at Santa Fe, but no concrete result was indicated in the last advices. It has been freely predicted at the New Mexican city that Arizona will not enter into any compact at this conference. Although some points have been cleared up, there still remain widely divergent views on the part of delegates from Nevada, Arizona and California, to bring about agreement between whom the conference was called. Delph E. Carpenter, interstate water commissioner for Colorado, said he believed that first there should be a compact among the four upper basin states.

High state officials at Phoenix, Ariz., display reticence when asked to forecast the probable action of the Arizona Legislature. It is generally assumed there that before the Legislature takes any decisive action a popular referendum will be held to determine the people's attitude. No official statement to this effect, however, has been forthcoming.

Two of the four members of the Utah House of Representatives on that state's delegation to Santa Fe have counseled immediate ratification of the six-state Colorado basin compact, while the other two and the two members of the Senate have advised against any hasty action.

Colorado, New Mexico, Texas Sign Rio Grande Pact

Negotiation at Santa Fe last week of a tri-state compact between Colorado, New Mexico and Texas having as its ultimate goal permanent allocation of the waters of the Rio Grande River brought to an amicable conclusion two months of active negotiations between representatives of the three states. Before the compact becomes effective, it must go to the legislatures of the states involved for ratification and also to Congress for concurrence.

The effect of the compact is to create a truce among the three states until 1935, during which truce Colorado agrees not to further deplete the waters of the Rio Grande River. At the expiration of the period the compact provides for the appointment of a new tri-state commission to consider a permanent basis for allocation of the waters between the three states.

William J. Donovan, assistant to the Attorney General, signed the compact as the official representative of the United States government.

In the States' Legislative Mills

Moorhead Bill Passes Indiana Senate—Seven Maine Power Bills—New York Commission May Be Investigated—Texas Defeats Plan to Set up a Commission

HOLDING companies will come under commission regulation in Indiana if the Moorhead bill, which has passed the Senate, also passes the House. Maine still struggles with the problem of exporting or not exporting hydro-generated electricity. New York's Public Service Commission is, by bipartisan agreement, fairly certain to become the subject of an inquiry designed to improve its efficiency and speed it up. Texas has rejected the measure to set up a public service commission. In numerous other states utility questions interest the legislators.

ARKANSAS.—The House of Representatives has passed, 48 to 38, a bill to prohibit utility companies from making service or other charges above their regular rates.

IDAHO.—A bill has been introduced in the Senate prohibiting export of power from the state.

INDIANA.—The Senate has passed the Moorhead bill, which would bring public utility holding companies under jurisdiction of the Indiana Public Service Commission. The vote on the measure, which now goes to the House, was 36 to 8. The bill provides that a holding company owning 50 per cent or more of the common stock of an Indiana operating utility, or which otherwise controls or dominates it, shall be declared a utility under the Shively-Spencer act, the original control act, and brought under the jurisdiction of the commission. The primary purpose of the measure, according to its author, is to permit the commission to inquire into all contractual relations between Indiana utilities and their holding or parent companies in order to get at the facts concerning their equity. The bill was opposed as tending to drive capital out of the state.

An acute financial problem faced by the Indiana Public Service Commission as a result of undertaking an investigation of the seventy-million-dollar Insull merger petition for electric and interurban railway properties has been laid before members of the ways and means committee of the House of Representatives, with a plea for restoration of the commission's revolving fund. Because of inadequate resources, the commission announced it either would be forced to stop its investigation of the merger program or else close its doors to all other cases.

KANSAS.—A resolution has been introduced in the Legislature providing for home rule of public utilities by all cities of the state with a population of 2,500 or more.

MAINE.—An order introduced by Senator Harold H. Murchie of Washington, providing for the appointment of a special committee of the two houses of the Legislature to consider as a matter of state policy the question of exportation of surplus hydro-electric power, has passed both houses in amended form. This constitutes the first definite action on any of seven power measures now before the lawmakers. Senator Oakes has what is thought to be a merely strategic bill for the outright repeal of the present law. Senator Carleton has a bill for limited exportation, the needs of the state to be safeguarded and the measure to be submitted to a state-wide referendum. One House measure contemplates the appointment by the Governor of five men to represent Maine upon a joint commission with the other New England States to enter into a treaty, with the consent of Congress, covering water-power resources. The Senate is thought to be favorable to exportation. The House, with a large granger representation in its 150 members, is suspicious and conservative.

MARYLAND.—The bill providing for the election of the members of the Maryland Public Service Commission instead of their appointment by the Governor has been killed by the General Assembly.

A bill has been introduced to give the Public Service Commission authority to regulate electricity brought into Maryland from another state.

MINNESOTA.—The Senate, by a vote of 59 to 6, has adopted the McLean resolution asking Congress to pass the Shipstead-Newton bill in its present form. The purpose of the federal measure is to protect international boundary waters against changes in level without government consent.

A Senate bill to allow bonds to be issued on 75 per cent of the property of public utility companies has been referred to the committee on banks and banking.

Representative Stockwell of Minneapolis has introduced a measure which would authorize the state to acquire, develop and operate water power and to issue up to $50,000,000 in bonds to finance its operations.

Power companies are preparing to contest the legality of the Lightner water-power control bill now before the House on the ground that it would give the Railroad and Warehouse Commission power to regulate rates for energy produced by water power but would not regulate that produced by steam. The bill imposes an annual rental fee of 25 cents per horsepower and provides that every power dam constructed in the past would have to be surveyed and obtain a permit.

MISSOURI.—Representatives Hastings, Britain, Rollins and Kennedy have introduced in the Missouri House of Representatives a series of bills which

if enacted into law would greatly reduce the valuation of public utilities for rate-making purposes. The Hastings bill fixes valuation at the tax assessment value plus 10 per cent. This measure would force utilities to raise their tax assessments or accept a reduction in rate valuations, which the Public Service Commission now fixes. The Britain-Rollins-Kennedy bills would amend the Public Service Commission act to provide that in arriving at rate-base values the commission shall only consider "that property used and useful in furnishing such service or commodity." This would eliminate "going concern value."

The House has killed a bill reported favorably from committee calling for the creation of a state commission to make a survey of water-power resources and to recommend legislation for conserving them.

The municipal corporations committee of the House has reported favorably a substitute terminable-permit bill drafted by Representative Blair, who introduced the original measure sponsored by the Missouri Public Utilities Association. The substitute, applying to all utilities but telephone companies, makes it possible for them to surrender their franchises for terminal permits to be issued by the Public Service Commission subject to revocation for misuse or non-use or purchase by the municipalities served.

MONTANA.—The House of Representatives, after a prolonged debate, has killed a measure proposing a 2 per cent gross proceeds tax on hydro-electric plants.

NEBRASKA. — Attorney-General Sorensen insists that the power companies ought to close up their "propaganda factories" and "get out and stay out of politics." The utterance is intended to assist the project now before the Legislature of allowing municipal plants to build as far as 25 miles in any direction to serve customers. "If the municipalities are denied this right," Mr. Sorensen says, "then farmers in those sections where they operate plants will be practically forever barred from the blessings of light and power, since no private company will build to the boundaries of cities which it cannot serve. The power companies are entitled to fair treatment, but that is all."

Hearings have begun before a Senate investigating committee on the charges that members of the State University engineering faculty have been improperly receiving financial rewards from the National Electric Light Association.

NEW YORK.—Two bills designed to bring an inquiry into the New York Public Service Commission have been introduced at Albany. No charges of wrong conduct are made against the commissioners, but a survey in the interest of greater efficiency and expedition is asked. The movement is non-partisan, the first bill, known as the Sheridan-Sargent measure, being fathered by a Democratic senator and a Republican assemblyman. It contemplated five members, three of whom would be appointed by the Governor and one each by the Temporary President of the Senate and the Speaker of the House. This bill will in all probability be superseded by the Thayer-Dunmore measure, sponsored by the responsible Republican leaders, which establishes a commission of nine members, to consist of the Temporary President of the Senate and two persons appointed by him, the Speaker of the Assembly and two persons appointed by him, and three others appointed by the Governor. To provide for ample representation of public utility experts the legislative leaders are to be permitted to name as their appointees persons not members of their respective houses.

Governor Roosevelt approves the proposed inquiry, but has criticised the substitute bill. Among its objects are to study the general business methods and practices of public utility corporations; the general financial plan or plans under which they function, including the operation of holding corporations and investment trusts dealing in public utility securities; the general effect of such operation upon costs, rates, charges and adequate service; the relationship of utility corporations with one another, the relationship of holding corporations and investment trusts dealing in public utility securities to utility corporations as regards stock ownership, management and service contracts, interlocking directorates, the public service commission law and all other laws pertaining to the regulation of public utility corporations.

Other bills introduced would bring submetering under commission control, require utility employees entering others' premises on duty to be uniformed, and amend the law licensing electricians.

NORTH DAKOTA.—Attack on an appropriation of $40,000 to permit the Board of Railroad Commissioners to evaluate public utilities property in the state was met by the statement that the appropriation was not to create a new bureau, but to provide for a survey of utilities under the old law and to consider new rates.

OKLAHOMA.—A bill introduced in both houses alters the definition of "public utilities" by providing that surplus energy manufactured by individuals or firms not utilities may be sold to a public utility manufacturing energy or to a municipality without the said individual or firm becoming a utility.

OREGON.—A bill to abolish the name "Public Service Commission" and substitute therefor "Department of Public Works" has been introduced in the Senate. This bill also provides that, instead of three members appointed by the Governor, the new department be supervised by one member at a salary of $6,000 per year who, in turn, shall appoint two assistants.

Although Oregon's electorate voted down an initiative measure which was designed to close the state's rivers to further development of hydro-electric power, the Legislature is considering a bill which provides for the withdrawal of the waters of Rogue River from appropriation and to prohibit the construction of dams or obstructions in the main channel of the stream. The measure would prohibit development from Big Butte Creek to the ocean, approximately 100 miles. Some important power sites are along this section of the river, among them Hell Gate Gorge.

TENNESSEE.—A bill declaring that the state has complete control of its water-power resources and that any action with regard to these sites must be delegated by the Legislature has been introduced. It would deprive the Railroad and Public Utilities Commission of authority over water-power sites until legislation conferring it was passed.

TEXAS.—All prospects of the Legislature creating a public utility commission or enacting any law of regulatory nature were killed when the Senate voted to lay on the table the Holbrook bill to this end—the bill that is favored by Governor Moody. It is regarded as probable that the Governor will recommend the enactment of the measure to the special session which will be convened immediately upon adjournment of the constitutional regular session early in March.

WEST VIRGINIA.—Many changes were made in the Hugus water-power bill by the judiciary committee of the Senate before reporting that measure and having it made a special order for February 27. A few of these follow: The Public Service Commission is to have power to regulate the "service" as well as rates and charges for service, as provided in the original bill. The commission shall require any licensee to supply the reasonable requirements of consumers resident in West Virginia before permitting the disposal of power outside the state. All issues of securities payable at periods of more than twelve months after the date thereof and all mortgages shall be subject to the approval of the Board of Public Works of the state. Impounding of water and operation of dams shall be subject to flood-control regulations adopted by the state or the United States.

Maine's Power Fact-Finding Committee Reports

The fact-finding committee of the Maine Development Commission which has been surveying Maine's power problems has sent its report to the Legislature. The report, which deals with firm, primary, secondary and surplus power, brings out not only that the Maine water-power plants, as at present developed, are capable of producing considerably more power than is being used, but that if those resources which could be developed economically were harnessed, Maine could produce as much power as the state would use 80 years from now at the normal rate of industrial growth.

To Adjust Canada Power Jurisdiction at Home

Premier King Will Not Take Question to England—St. Lawrence Treaty Is Agitated — Beauharnois Project Awaits Order in Council

THE recent decision of the Supreme Court of Canada in the dispute between the Dominion and the provinces over water powers will not be referred to the British Privy Council. This was made clear by Premier King at Ottawa on February 25, when he announced that the government had invited the Premiers of Ontario and Quebec to meet representatives of the federal government after the close of the present session of Parliament to discuss the water-power question. An effort will be made at this conference to arrive at some settlement which will secure the provinces in their full rights with respect to power and secure the Dominion with respect to all national interests involved.

When the above announcement was made the Prime Minister was speaking on a motion by T. L. Church, Conservative member for Toronto, calling for action to enter into a treaty with the United States providing for immediate development of the St. Lawrence. Mr. King made it clear that no treaty would be entered into for the St. Lawrence development until the provinces had been consulted. The Prime Minister also stated that the attitude of the Dominion was that there would be no export of power resulting from the St. Lawrence development.

It is held to be likely that in each dispute over power which arises in future there will be an agreement with the provinces to consider it on its merits. In the most conspicuous of recent or present cases—that of the Beauharnois company—there is already agreement with the Province of Quebec, which has conferred upon the company its legislative sanction, leaving it to the Dominion government solely to pass upon the sufficiency of remedial works for the adequate protection of navigation. The present status of this matter is that the engineers have finally reported and a cabinet subcommittee has recommended the plans subject to a long list of conditions. To give official effect to it, an order in Council is necessary.

Testimony Calls Submetering Service Inferior

Little, if any, new light was thrown on the submetering problem in Greater New York at additional hearings in that city before the State Public Service Commission this week. Charles L. Harold, general sales manager of the Brooklyn Edison Company, testified concerning inefficient service furnished by the submetering companies as compared with that direct from the central station, which took care of three hundred thousand "trouble" calls a year from customers. J. R. Malone, secretary of the New York & Queens Electric Light & Power Company, testified that 25 private electrical plants in Queens had been removed and service by his company substituted for them.

The inquiry took a wide range. Tables showing the price of electricity furnished the city government in 1928 were filed by R. B. Grove, secretary United Electric Light & Power Company, and an attack was made on the Brooklyn Edison Company for alleged favoritism to the Bush Terminal Company, a very large customer. Hearings will be resumed on March 5.

Purchases and Mergers

That a majority interest in the Potomac Electric Power Company of Washington, D. C., was acquired by the North American Company, previously a stockholder, about a year ago, at the time when the power and railway interests at the capital were the subject of hearings before the District of Columbia committee of the House in anticipation of a proposed merger of railway interests in Washington, has recently been made clear through the listing by the North American Company of the Potomac Electric Power among its subsidiaries.

Referendum action on the proposed sale of the Macedon (N. Y.) municipal power plant to the Rochester Gas & Electric Corporation has been set for March 19. The Phillips utility has bid $26,000.

A petition by the Indiana Service Corporation, Fort Wayne, Ind., for authority to buy the Preble (Ind.) Light & Power Company at a cost of $20,000 has been filed with the Indiana Public Service Commission.

Bayport (Minn.) voters will ballot a second time on sale of the municipal electrical distribution system to the Northern States Power Company. The sale, defeated at a special election February 11, will be voted on at the regular poll March 12. The company offered $60,000.

The California Telephone & Light Company has applied to the Railroad Commission for authority to transfer all of its property to the Pacific Gas & Electric Company and to cease furnishing electric service in Sonoma, Mendocino and Lake Counties.

The Public Utilities California Corporation has applied to the Railroad Commission for authority to acquire the Needles Gas & Electric Company by the issue of $206,000 of capital stock for financing the acquisition and $178,400 of stock for retiring the funded debt of the acquired company. The same company asks authority to purchase the properties of the J. M. Hotchkiss Electric Company, serving Crescent City and vicinity, by the issue of $125,000 of capital stock for financing the acquisition.

Transfer of control of the West Canadian Hydro-Electric Corporation of Vernon, B. C., from Ralph A. Blanchard and associates of Portland, Ore., to R. E. Wilsey & Company of Los Angeles and other American Pacific Coast investment bankers is announced.

The Southern Cities Utilities Company, controlled by the United Utilities & Service Corporation, announces the acquisition of important electric and gas properties on the Spanish island, Mallorca, near Barcelona.

Federal Radio Commission's Fate Unsettled

The bill to extend the life of the Federal Radio Commission another year had not been passed by the Senate up to Thursday morning, though Senator Watson, who has it in charge, was desirous of applying cloture if necessary to insure its adoption, claiming that without it chaos would prevail in the radio world. Senator Watson refused to accept a compromise on the basis of nine months' extension.

Overthrow by the District of Columbia Court of Appeals of the commission's allocation in the case of WGY, the General Electric Company's broadcasting station at Schenectady, led to renewed attacks in the Senate on the "radio trust."

Practical Talks Help North Central Commercial Men

With the problems of introducing and selling modern electric appliances to the public as their convention theme, two hundred members of the Commercial Division of the North Central Electric Association discussed merchandising methods at a two-day session at Minneapolis on February 25 and 26. C. J. Strike, vice-president of the Northwestern Public Service Company, was chairman. Kenneth McIntyre of the Society for Electrical Development and Miss Eloise Davidson of the N.E.L.A. home economics department spoke at the first session, followed by Ernest Greenwood, commercial director N.E.L.A.

H. E. Young, Northern States Power Company, said that a feature of merchandising electric refrigerators had been the manner in which manufacturers themselves had developed the market. The power companies have done most of the pioneering, he said. "Twenty-five per cent of lost sales are due to the indifference of the salespeople," Walter S. Byrne, vice-president of the Kilpatrick Company, Omaha, Neb., and former sales manager of the Nebraska Power Company, declared, speaking on "Merchandising Pitfalls."

"How to Sell Better Home Lighting" was discussed by H. E. Rademacker, Edison Lamp Works, Chicago, and Ell Bennett talked of new developments and practices in the sale of electric refrigeration. L. M. Pharis of Duluth, president of the association, spoke at the dinner-dance on Monday evening.

Tuesday's program included practical talks by H. E. Kahlert, Northern States Power Company, and Val Thorsen of St. Paul. T. T. Parker, president Northwestern Public Service Company, Huron, S. D., spoke on merchandising policies at a luncheon meeting. "Capitalizing Customer Contacts," by W. S. Heald, Minnesota Light & Power Company; "The Oil-Burner Load," by A. K. Baylor, General Electric Company, and "Utilizing a Salesman's Time Properly," by J. D. Broome, A B C Manufacturing Company, Peoria, Ill., were other papers, followed by discussions.

Albuquerque Attracts Utility Men

Up-to-Date Subjects Draw Large Attendance to New Mexico Utilities Association Meeting at That City —Business Methods Discussed

EMPHASIS was placed on the importance of establishing and maintaining proper public and trade relations at the fourteenth annual convention of the New Mexico Utilities Association, held in Albuquerque on February 18-20. Excepting those handling purely technical subjects, virtually every speaker brought out forcibly that the development of the utility industry is dependent upon the good will of the public and of the other three branches of the industry.

Vice-President William W. Nielsen, manager New Mexico Power Company, Santa Fe, presided at the business sessions in place of President C. C. Ogle, who was recently transferred to a Texas property. Following the acting president's address, George E. Lewis, Denver, manager of the Rocky Mountain Committee on Public Utility Information, dwelt strongly on the desirability of convention delegates passing along the benefits derived from their attendance; Mrs. Ruth Steinhauser, director of public relations with the Texas-Louisiana Power Company, discussed "The Personal Element in Public Relations," and John J. Cooper, manager General Electric Supply Corporation, Denver, reviewed activities of the past year and pointed out that the residential field is still being neglected.

Fred Norcross, Home Gas & Electric Company, Greeley, Colo., told of the activities of the Commercial Section, N.E.L.A., of which he is division chairman. Mr. Norcross stressed the necessity of a proper rate structure in order to develop the load and thought that a 2-cent maximum rate is essential for general acceptance of the water heater.

K. W. Kissick, Deming (N. M.) Ice & Electric Company, told of his six years' experience in developing irrigation business. From the standpoint of bettering the load factor, Mr. Kissick recommended the use of ground storage tanks and smaller pumps to operate on a 24-hour basis.

Herbert Sands, consulting engineer, Denver, said that there are 148 different forms of rates in Colorado and urged more uniformity; "House Heating with Off-Peak Power" was presented by A. L. Jones, district manager General Electric Company, Denver, who told of the experiments being conducted in Fort Wayne, Ind., and A. C. Cornell, manager Graybar Electric Company, Denver, pointed out the economic necessity of the electrical wholesaler.

"Lest We Perish" was the subject discussed by George Bakewell, Jr., executive manager Electrical League of Colorado, Denver. Mr. Bakewell told of the aggressive manner in which other businesses are bidding for the consumer's dollar through national association activities and urged the industry to set the stage now in anticipation of the promotional plans soon to be launched through the Industry Sales Conference.

J. E. Loiseau, secretary Public Service Company of Colorado, Denver, opened Tuesday's session, discussing the proper selection and training of employees. He declared also that the utilities are paying 50 per cent more taxes than are economically justified. Francis C. Wilson, Water Commissioner of New Mexico, gave an analysis of the Boulder Dam situation and predicted that the generating equipment would be operated by private enterprise. Carrier telephony on transmission lines was the subject of an address by R. W. Goddard, dean of engineering, State College, New Mexico.

All previous registration records were excelled at this convention. Officers elected are: President, William W. Nielsen, New Mexico Power Company, Santa Fe; first vice-president, Eugene A. Roberts, Southwestern Public Service Company, Carlsbad; second vice-president, Thomas C. Brown, Socorro Power & Light Company. B. L. Wiles, Albuquerque Gas & Electric Company, succeeds himself as secretary-treasurer.

High Level for Midwest Power Conference

Final Sessions Devoted to Heating, Ventilation and Refrigeration and to Power-Plant Operation and Economics— Savings from 1,200-Lb. Steam Pressure

OUT of the list of conspicuously good papers and discussions presented at the fourth annual Midwest Power Engineering Conference in Chicago it is hard to single out any one or more as of especial excellence. Starting literally at the bottom on the first day with papers on power-plant foundations, the program ranged through the problems of plant design, construction and operation. Attentive and intelligent interest marked every session because there was much to hold attention and to spur intelligence. The striking possibilities of improving the design and performance of equipment through research in molecular and atomic arrangements of materials, the raising of limitations in turbine design, new departures in construction procedures, the combat against corrosion, selection of metals in the manufacture of equipment, the dovetailing of the fields of industrial-plant and central-station power, refrigeration as a user of electrical energy, economies of high steam pressures, modern stoker equipment and many other matters of vital concern to power-plant builders and operators were treated exhaustively, not merely touched upon superficially. In the ELECTRICAL WORLD for February 16 (page 356) notices of the first two days' papers were printed. Here follows an account of the two following days. Fuller abstracts of some of the papers are likely to appear in coming issues.

Speaking at a luncheon meeting, R. C. Allen of the Westinghouse Electric & Manufacturing Company said that the whole development of steam turbines to larger and larger capacities would not be in the direction of the multiple-cylinder machine. As the factors of ignorance in turbine design are reduced and eliminated and average stress limits are raised through application of the results of research on local stresses, it becomes apparent that maximum capacity has not yet been reached for the single-barrel unit. The obvious economies of the single unit as against the multiple in terms of materials and thermal and pressure steam losses are incentives to the further development of this type.

Air cooling and ventilation were treated in a paper by S. C. Bloom, consulting engineer of Chicago, with particular reference to office buildings and to obviating the let-down in personal efficiency of office workers during hot weather. The work of the research laboratory of the American Society of Heating and Ventilating Engineers was explained by Samuel P. Lewis, who gave an account of the investigations in this field in various universities and governmental bureaus. The important part played by refrigeration in the preservation of foods, including transportation, was brought out by A. J. Authenreith, vice-president of the Middle West Utilities Company. In its total use of electrical energy refrigeration represents more than 3 per cent of the national production of power.

A surprising error in the derivation of the fundamental theory for the centrifugal pump was pointed out by Prof. A. F. Schurzer of the University of Michigan in a paper on centrifugal pump economics. The discovery of this error explains the wide difference usually found between theoretical and actual pump performance. The error is caused by the double inclusion of pressure created by centrifugal force in the formula, it appearing in both the pressure and velocity head factors.

R. J. Gaudy, executive engineer of the Sessions Engineering Company, spoke on the co-ordination of industrial-plant and central-station power. There are definite factors to determine the relative economies of methods of power supply, he said, and no good is ever done by the glossing over of neglect of these factors.

The welding of pipes in power plants is not yet widely practiced because its virtues and applications are not fully appreciated, declared F. G. Outcault, development engineer of the Linde Air Products Company. Another reason for lack of acceptance of welded pipe is the fact that engineers are not sure of the strength of welded joints. But welds, properly made under definite procedure control, can be counted on to be consistently stronger than the metal jointed, Mr. Outcault said.

The savings made by the installation

of a 1,200-lb. turbine unit in the Northeast station of the Kansas City Power & Light Company were detailed by Edwin Jowett, chief engineer of that company, whose paper was read by J. A. Keeth. The operating economies instanced in the paper were corroborated by experiences in Milwaukee and Boston, these being brought out in the discussion.

J. P. Morrison of the Hartford Insurance Company presented an interesting paper on the development of maintenance and engineering insurance. This was followed by a discussion of modern stoker equipment by C. F. Hirshfeld, who pointed out important factors of design as exemplified by the trend of stoker and furnace practice.

About nine hundred attendants at the conference and their guests were present at the annual banquet, where Walter Dill Scott, president of Northwestern University, spoke on the significance of power in the cultural development of civilization.

Geologists Talk to Mine Engineers on Dam Building

Before the annual convention of the American Institute of Mining and Metallurgical Engineers, held at New York last week, the disaster to the St. Francis Dam in southern California a year ago was cited in a geological symposium to stress the importance of thorough geologic research before dam building.

According to Prof. Chester K. Wentworth of Washington University, St. Louis, "it is fairly evident from the preliminary reports of various geologists that unsuitability of the normally weak conglomerate on which parts of the dam rested to withstand the action of water was mainly responsible for its failure."

L. C. Glenn, professor of geology at Vanderbilt University, Nashville, Tenn., urged state regulations requiring a thorough geological examination preliminary to any important dam construction. Prof. Charles Berkey of Columbia University said that too often the problems involved in damming waters were regarded as engineering problems when they should be shared by the geologist. All engineering students should be required to take geology courses, said Prof. Charles Wilson Brown, head of the geological department of Brown University.

Indianapolis Power & Light Plans 140,000-Kw. Plant

A generating plant rated at 140,000 kw., to cost when completed approximately $16,000,000, will be erected on the east bank of the White River south of Indianapolis, according to plans of the Indianapolis Power & Light Company. The 160-acre site of the proposed plant runs west from Harding Street to the White River. The ground was bought in 1924 by the Indianapolis Light & Heat Company. The construction program calls for the order of two 35,000-kw. turbo-generators this year, to be in operation by 1931. Additional units of the plant will be erected as demands for power warrant. The first two units will increase the generating capacity of the company by 75 per cent, according to Emmet G. Ralston, vice-president and general manager of the company.

When completed this plant will have a battery of sixteen boilers, each equipped with special stoker and draft devices making possible the use of Indiana coal and each having its own short steel stack. There will be accessory buildings for materials and supplies, as well as an out-of-door substation immediately adjacent to the station. Current will be produced at 13,000 volts and carried directly to the substation, where it will be stepped up to a higher voltage for distribution to other substations to be erected around the edge of the city, to which a high-tension line will be built. In the city interchange of power among the four stations of the company will be improved. Heavy steel and masonry will be used for station construction.

Rival Applicants for Holston River Sites Heard

Significance is attached in Washington to the recent joint hearing held in Nashville by the Tennessee Railroad and Public Utilities Commission with representatives of the Federal Power Commission. Major Glen E. Edgerton, the commission's chief engineer, and Louis H. Watkins, the War Department's district engineer, in charge of the survey of the Tennessee River, were present for the Federal Power Commission.

The hearing revealed that the American Cyanamid Company is interested in the Holston River Power Company, which has applied for rights on the South Fork of the Holston River above Kingsport. In conflict with that project is the application of the Tennessee Eastern Electric Company, which within the last year has come under control of the H. L. Doherty interests. This company proposes to proceed immediately with the construction of a hydro plant 6 miles above Kingsport. The Holston River Company desires to construct three developments with the idea of furnishing primary power to be used in electrochemical manufacture. Apparently this company was able to establish that it plans the more complete development and that its project is in substantial accord with the plan recommended as a result of the government's survey of the Tennessee Valley. The Tennessee Eastern Electric Company at the hearing relied largely upon the fact of its ownership of a large proportion of the land area required for its reservoirs. It challenged the authority of either the state or the federal commission to prevent its proceeding with its project.

Prizes Offered for Slogans to Boom Industrial Heat

Seven prizes, totaling $500, will be awarded by the National Electrical Manufacturers' Association and the National Electric Light Association for the best slogans to promote the use of electric heat in industry. Each contestant may submit not more than three slogans, and each slogan must be accompanied by an analysis not exceeding one hundred words. Preference will be given to brevity. The awards will be made on the basis of the best slogan and analysis. The first prize will be $250, second $100, third $50, and there will be four of $25 each.

For the guidance of contestants the joint committee of the two bodies on electric furnace development, sponsor of the contest, states that the following advantages are to be gained by the use of electric heat in industry: (1) Ease and accuracy of temperature control; (2) uniformity of temperature throughout furnace; (3) ability to maintain predetermined temperature conditions and obtain uniform products day after day; (4) economy through reduction of defective products and reduction of metal losses when melting metal; (5) cleanliness and improved working conditions; (6) safety to people and property; (7) wide applicability wherever heat is required.

Further particulars can be had from the committee, care of National Electrical Manufacturers' Association, 420 Lexington Avenue, New York. Slogans must be mailed before May 30. Results of the competition will not be made public before June 30.

McGraw-Hill Company Buys "Aviation"

Aviation, the oldest aëronautical magazine in the United States, has been purchased by the McGraw-Hill Publishing Company. The magazine, which is published weekly, was acquired from the Aviation Publishing Company of New York. Earl D. Osborn, who has been publisher of the periodical for several years, will join the McGraw-Hill organization and continue his activities in the field of the magazine. This field encompasses aircraft manufacturers, makers of engines and parts, airports, distributors and all others who are interested professionally in aëronautics.

In a signed statement James H. McGraw pointed out that in their entirety McGraw-Hill publications now cover the five major branches of engineering and the industries allied with them. They embrace also two divisions of the field of transportation, the electrical and radio trades, the food and textile industries, the interests of production management and the broad field of commerce, business and finance. Aviation is becoming a useful tool in modern business and is a new basic industry. The acquisition of the magazine is a

logical development in publishing because aviation is of great interest to several of the publications in the McGraw-Hill group and because air transportation is fast becoming of vital importance to industry and business.

Hughes to Review Hearings on Chicago Diversion

Hearings will be held at Chicago, beginning March 25, before Charles E. Hughes, as special master by designation of the United States Supreme Court, with the object of framing a decree to facilitate and expedite the cessation of the diversion of 8,500 cu. ft. per second from Lake Michigan to the Chicago Drainage Canal.

The hearings appointed by Special Master Hughes are the outcome of the decision of the United States Supreme Court (ELECTRICAL WORLD for January 19, page 167) holding that the Secretary of War in the first instance was without authority to grant a permit to the Chicago Drainage District to divert the waters of the lakes for any purpose except navigation on the Chicago River and directing the establishment of a sewage disposal system which eventually will make such diversion unnecessary. At the Chicago hearings representatives of the State of Illinois and the Drainage District will have an opportunity of presenting their side of the case. Other hearings to be held at the discretion of the special master, probably in Washington, will afford similar opportunity to New York, Michigan, Wisconsin, Minnesota and Ohio.

Tacoma Plans City Hydro Plant on Nisqually

The city of Tacoma, Wash., has just filed with the state hydraulics supervisor its plans for a municipal power and light undertaking to be started in 1932, and built at an estimated final cost of $25,000,000. The announcement comes while work is under way on the second unit of the city's Cushman Dam development. The new project will be centralized 30 miles southeast of Tacoma and 75 miles from the Cushman plant. It involves a development on the Nisqually River of 150,000 hp., eventually to be doubled.

An earth-filled dam with a height of 250 ft. above the river bed, a top length of 1,600 ft. and a bottom measurement of between 500 ft. and 600 ft. would form at Alder a reservoir with a length of more than 7 miles and an area of nearly 11 square miles.

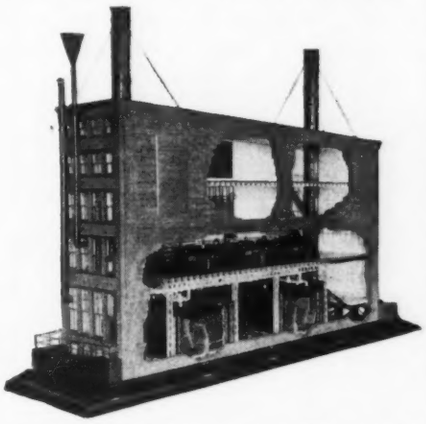
Four dams, operating independently, would be located respectively two miles east of Alder, 2 miles west of Alder, where a concrete-arch dam would be built in the natural rock canyon; at La Grande, where an existing plant would be rebuilt and enlarged, and 6 miles west of La Grande, in the bend of the river, where another arch dam would be erected.

The fourth site is 3 miles upstream from sites previously filed on by the city of Centralia for a municipal light and power plant, as already reported in the ELECTRICAL WORLD. The Tacoma project would, it is maintained, help Centralia's by increasing the flow.

Still another Nisqually River project, covering a power plant to cost $1,500,000 and be located near the town of Yelm, 30 miles southeast of Olympia, is outlined in papers filed with the state hydraulics supervisor by Will H. Schwieson of Tacoma. This undertaking would use 1,050 sec.-ft. of water from the river and would have an estimated output of 25,000 hp. The point of diversion would be about 7 miles southeast of the town of McKenna, where a concrete diverting dam, 3 ft. high and 230 ft. long, would lead the water into the head of the 10.5-mile earth canal to carry the water to the plant. In this way a 210-ft. fall would be harnessed.

Briefer News

NEW YORK EDISON MAKES MODELS OF OLD PEARL STREET STATION.—Three working models of the old Pearl Street generating station of the Edison Electric Illuminating Company, the first central electric station in the world, have been made by the mechanical



construction shops of the New York Edison Company. The work was personally supervised by John W. Lieb, senior vice-president of the company, to insure historical accuracy. Mr. Lieb was the station's first electrician. These models, which were made for historic reference and to serve as concrete records of a station that ushered in the electrical age, are built on a scale of one-half inch to one foot. They show all the equipment and apparatus with which Edison began the epochal generation and distribution, for public sale, of electrical energy to the lower end of Manhattan on Sept. 4, 1882. Operated by a small motor, the ventilating and forced-draft system, the reciprocating engines and the famous Jumbo dynamos all run just as they did on that first day. Each model is 62 in. long, 34 in. high and 13 in. wide, with two smokestacks rising 14 in. over the roof. They show the four floors which composed the Pearl Street station, and each piece of equipment has been reproduced.

CORRELATING COMMITTEE OF N.F.P.A. PROBABLY TO MEET MARCH 25. — The correlating committee set up by the National Fire Protection Association, as reported last week (page 408), to formulate Article IX and any conflicting articles for the 1929 National Electrical Code will, it is expected, meet in New York City on or about March 25.

OIL REFINERY DISCARDS ITS OWN PLANT AND BUYS CENTRAL-STATION POWER.—Announcement is made in the Shreveport (La.) newspapers by the Southwestern Gas & Electric Company that the Louisiana Oil Refining Corporation has sold its own 1,080-kw. generating plant and is now purchasing its entire supply of electrical energy from the company, this being approximately 500,000 kw.-hr. a month.

HAMILTON, OHIO, MAY DOUBLE LIGHTING PLANT.—Municipal officials of Hamilton, Ohio, report that its new electric plant, installed at a cost of $950, has proved so satisfactory that profits from operations will be adequate to pay for an additional 7,000-kw. unit, doubling the present capacity. It is recommended that this addition be made at once and standby service from the Union Gas & Electric Company of Cincinnati discontinued. The cost will be about $350,000.

THORNAPPLE (WIS.) HYDRO PLANT GOES ON LINE.—The new hydro-electric plant of the Lake Superior District Power Company, at Thornapple, Wis., was placed on the line February 11. The plant is rated at 2,300 hp. and is entirely automatic. There are two generators of equal size. This is the first of three developments that will be built by this company on the Flambeau River within a radius of 8½ miles of Ladysmith, Wis. They will all be low-head developments and together will generate approximately 10,000 hp.

SNOWDEN DAM ON JAMES RIVER UNDER WAY. — The Hydro-Electric Corporation of Virginia is building a 1,500-ft. concrete dam and 10,000-hp. power house on the James River near Snowden, above Big Island. It is understood that a large part of the energy to be generated at the new plant will be used by the Bedford Pulp & Paper Company at its Big Island plant. I. J. Marcuse is president of that company and vice-president of the Hydro-Electric Corporation.

ARIZONA UTILITIES ASSOCIATION TO MEET APRIL 4-6.—The fourth annual convention of the Arizona Utilities Association will be held at the El Conquistador Hotel, Tucson, Ariz., on April 4-6 instead of April 18-20, as formerly announced. P. M. Downing, president of the Pacific Coast Electrical Association, will be one of the principal speakers and Clark Baker of the National

Lamp Works of the General Electric Company, Oakland, Calif., will discuss proper lighting. Many phases of the industry will be covered during a two-day business session. The third day will be devoted to a trip through the old Spanish missions along the Mexican boundary, ending with a dinner-dance at Nogales, Sonora, Mexico.

ADVERTISING CAMPAIGN PREPARED BY CHICAGO ELECTRIC ASSOCIATION.—A series of nineteen advertisements for publication in seven Chicago newspapers and reaching about two and one-half million people at each insertion has been prepared for use during 1929 by the Electric Association, Chicago. These advertisements, which will be published in half-page display at intervals through the year, are general in that they refer to no specific interest or group of interests in the industry, but are very definite in their appeals to readers and in their contents.

GHOST RIVER HYDRO SITE IN ALBERTA MAY HAVE UNIT READY THIS YEAR.—In announcing that between $3,000,000 and $4,000,000 will be spent by the Calgary Power Company this year for further development of power in Alberta Province, President Gaherty states that satisfactory progress is being made on the initial installation at the Ghost River power site, where it is hoped to have the first unit of 18,000 hp. in operation in time to carry the peak load in the latter part of the year. Pending the completion of this enterprise the company is serving six municipalities in the vicinity of Edmonton. It now holds franchises in 76 cities, towns and villages throughout Alberta.

ROCKY RIVER PLANT IN CONNECTICUT VIRTUALLY COMPLETE.—The Connecticut Light & Power Company's hydro-electric plant on the Rocky River is now virtually completed. It will produce 33,000 hp., serving as an auxiliary to the steam generating plants of the company. More than two years were required to complete the project, which includes an artificial lake covering 8 square miles with a shore 60 miles long touching the towns of Danbury, Brookfield, New Fairfield and New Milford. Water is pumped from the Housatonic 230 ft. below the lake, actually going uphill for power creation.

PUBLISHERS' GROUP TO VISIT THE SOUTH.—Rapid industrial growth of the South is responsible for the decision of a group of executives and editors of the McGraw-Hill Publishing Company to visit important Southern manufacturing centers in the first two weeks of March. The ELECTRICAL WORLD will be represented in the party, which will leave New York on Sunday, March 3, and proceed to Charleston, West Va.; Richmond, Va.; Greensboro, Winston-Salem, High Point and Charlotte, N. C.; Greenville and Spartanburg, S. C.; Savannah and Atlanta, Ga.; Birmingham, Ala., and Chattanooga, Kingsport and Elizabethton, Tenn. It will leave for home Saturday, March 16.

CONSTRUCTION OF PRIEST RAPIDS PLANT LOOKED FOR.—March 1 marks the close of the period in which construction work on the hydro-electric development planned for Priest Rapids on the Columbia River in Washington State was to begin under the license issued to the Washington Irrigation & Development Company. The initial installation at this site was placed at 340,000 hp. and the ultimate capacity at 750,000 hp. According to Charles Donnelly, president Northern Pacific Railroad, as quoted in Seattle dispatches, "Electric Bond & Share and General Electric interest" have spent $1,000,000 in preliminaries, and his railroad is planning a cut-off route to place it in an advantageous position to compete for traffic at the industrial center which is expected to spring up near the development. The dispatches said that work would start on time.

Coming Meetings

[A complete directory of electrical associations, with their secretaries, is published in the first issue of every volume. For latest list see issue for January 5, page 80.]

Oklahoma Utilities Association — Huckins Hotel, Oklahoma City, March 12-14. E. F. McKay, 1020 Petroleum Bldg., Oklahoma City.

Florida Engineering Society — Fort Harrison Hotel, Clearwater, Fla., March 14-16. J. R. Benton, Gainesville, Fla.

Illinois State Electric Association — Springfield, Ill., March 14 and 15. G. W. Schwaner, 205 Illinois Mine Workers' Bldg., Springfield, Ill.

American Society for Testing Materials — Stevens House, Chicago, March 19-22. C. L. Warwick, 1315 Spruce St., Philadelphia.

American Institute of Electrical Engineers—Regional meeting, Cincinnati, March 20-22; regional meeting, Dallas, Tex., May 7-9. F. L. Hutchinson, 33 West 39th St., New York.

American Society of Mechanical Engineers—Knoxville, Tenn., March 21-23. C. W. Rice, 29 West 39th St., New York.

Northwest Electric Light and Power Association — Engineering Section, Walla Walla, Wash., March 25-27. Berkeley Snow, 1206 Spalding Bldg., Portland, Ore.

Arizona Utilities Association—El Conquistador Hotel, Tucson, April 4-6. Lee C. McCullough, 134 South Central Ave., Phoenix.

American Welding Society—Engineering Societies Bldg., New York, April 22-26. N. N. Kelly, 29 West 39th St., New York.

Middle West Division, N.E.L.A.—Hotel Fontenelle, Omaha, Neb., April 24-26. T. A. Browne, Lincoln, Neb.

Southwestern Division, N.E.L.A. — Arlington Hotel, Hot Springs, Ark., April 30-May 3. S. J. Ballinger, San Antonio Public Service Co., San Antonio, Tex.

Southwestern Public Service Association—Hot Springs, Ark., April 30-May 3. E. N. Willis, 403 Slaughter Bldg., Dallas, Tex.

Arkansas Utilities Association — Arlington Hotel, Hot Springs. Ark., April 30-May 3. R. I. Brown, Arkansas Power & Light Co., Little Rock, Ark.

Indiana Electric Light Association — Hotel Gary, Gary, Ind., May 1-3. William Stokes, 1548 Consolidated Bldg., Indianapolis, Ind.

East Central Division, N.E.L.A. — Louisville, Ky., May 7-10. D. L. Gaskill, Greenville, Ohio.

Southeastern Division, N.E.L.A.—Asheville, N. C., May 8-10. C. M. Kilian, 207 Bona Allen Bldg., Atlanta.

National Electrical Manufacturers' Association — The Homestead, Hot Springs, Va., May 20-25. S. N. Clarkson, 420 Lexington Ave., New York.

American Electrochemical Society—Toronto, May 27-29. C. G. Fink, Columbia University, New York.

National Electrical Wholesalers' Association—The Homestead, Hot Springs, Va., May 27-31. E. Donald Tolles, 165 Broadway, New York.

VARIED PROGRAM FOR ELECTRIC HEATING SYMPOSIUM AT CAMBRIDGE.—On February 28 and March 1 a New England industrial electric heating conference was to be held at the Massachusetts Institute of Technology, Cambridge, under the auspices of the National Electric Light Association and with the co-operation of the Institute and the Associated Industries of Massachusetts. The first day's program covered the melting of brass and other alloys, soft-metal melting, industrial ovens and arc welding. Heat treating, vitreous enameling, hardening and economic problems were scheduled for the second day.

EVERETT, WASH., PLANS FOR FUTURE CITY HYDRO PLANT ON SULTAN RIVER.—Although no constructional work would be undertaken before January 1, 1935, the city of Everett, Wash., has just outlined its two-million-dollar water-power project in filing claims in the state hydraulics office at Olympia. The plan, largely developed in the interests of the pulp and paper industries in the Everett industrial section, asks an appropriation of 110 sec.-ft. of water from the flow of the Sultan River. An earth-fill horseshoe-type dam, 45 ft. high, 800 ft. along the top and with a 700-ft. bottom, and a 22-mile pipe line would be necessary. The reservoir would inundate 435 acres.

ADIRONDACK PROJECT FORBIDDEN PENDING COURT DECISION.—The New York Public Service Commission, pending the outcome of a suit in the State Supreme Court, has denied, without prejudice, a petition by the Low Power & Light Corporation for the right to build a water-power development on Bogg River and a transmission and distribution system in St. Lawrence County and the leasing of the Low company's plant in the townships to the village of Tupper Lake for supplying additional power to its municipal lighting plant. Litigation over the right of the village to purchase energy from any other than the Paul Smith's Electric Light & Power Company is involved.

ALABAMA MAYORS WANT REHEARING ON ELECTRICAL RATES. — The Alabama Public Service Commission has indicated its willingness to have a rehearing on the electrical rates recently prescribed for the Alabama Power Company if "sufficient reason therefor be made to appear." The Alabama Mayors' Association recently appointed a special committee which, after an investigation of the schedule, condemned it as unfair to the small consumer, President Hartwell of Mobile criticising the schedule and maintaining that the room fee levied under the new schedule is "a tax against all persons

who have electric connections whether they utilize them or not." The commission charged the Mayors' Association with seeking publicity rather than constructive results and declared the order the most constructive it had ever issued.

NEW RATES FOR ALBANY, N. Y.—The New York Public Service Commission has approved a new tariff of the New York Power & Light Corporation for electricity supplied in the city of Albany and surrounding territory. It provides a residential classification with a rate of 25 cents per counted room per month (minimum three counted rooms), plus 5 cents per kilowatt-hour for the first 10 kw.-hr. per month per counted room and 3 cents for all other energy; except that where the minimum monthly charge of 25 cents per counted room applies no bill will be rendered at a greater rate than 8 cents per kilowatt-hour. The new rate supersedes one scaling from 8 cents per kilowatt-hour for the first 200 kw.-hr. to 2 cents for consumption in excess of 5,000 kw.-hr. per month.

OIL-ELECTRIC LOCOMOTIVE GOES INTO PASSENGER SERVICE. — What is said to be the first oil-electric locomotive to be designed in the United States for strictly passenger service has been built for the New York Central Railroad and is being placed in service on the Putnam Division between High Bridge, New York City, and Brewster, N. Y. The engine is 59 ft. long, weighs 350,000 lb. and has a maximum tractive effort of 45,000 lb. The electrical equipment consists of two generators and four traction motors and was supplied by the General Electric Company. A year ago the railroad put in service the first through freight oil-electric locomotive, and still earlier it placed in service on the west side of Manhattan Borough the first oil-electric switching engine.

OTTAWA-TORONTO 220-KV. LINE TO BE DUPLICATED.—Duplication of the 220-kv. transmission line which was constructed between Toronto and the Ottawa River last year, at a cost of approximately $3,000,000, is to be made next summer by the Ontario Hydro-Electric Power Commission. The program as suggested is to proceed with the construction of the westerly half of the line first, with towers of design similar to those of the present circuit. This half will be available to tie in with the present line for the second increase of Gatineau power. Construction of the easterly half will then be proceeded with, so that the entire new line will be available by the fall of 1930, when the third increase from the Gatineau will be supplied.

RADIO TO BRIGHTEN ANTARCTIC NIGHTS FOR BYRD PARTY.—With two months of darkness about to settle over the Antarctic regions, Commander Richard E. Byrd and his companions in Little America are looking forward to radio broadcasts from civilization to help brighten the long night period. The General Electric Company's station, WGY, and its associated short-wave transmitters will begin to flash special programs to the Bay of Whales, 10,000 miles to the southward, beginning on March 9, at 11 p.m. Eastern standard time. The broadcasts will continue every Saturday night thereafter at that hour. It will be the purpose of the programs to transmit messages from friends and relatives of the men on the expedition and to broadcast music and other forms of entertainment.

NORTHERN MINNESOTANS AGAINST PROHIBITION OF PRIVATE DEVELOPMENT ALONG ONTARIO BORDER.—When the mass meeting of northern Minnesota property owners referred to in the ELECTRICAL WORLD for January 26 (page 213) was held at Grand Marais on February 12 it was made clear that Cook and Lake Counties are not yet ready to give approval to the Shipstead-Newton bill, now before Congress and favored by Governer Christianson. A four-hour discussion of the measure, which would prohibit private industrial utilization of property in the north country, including Superior National Forest and boundary territory, was followed by a unanimous vote of more than 200 persons present to withhold approval. Main objections were an anticipated increase in taxes and that no provision for industrial development of the territory is included. E. E. Johnson, president of the Pigeon Lumber Company of Port Arthur, Ontario, declared that future development of the two counties would be greatly hampered by passage of the bill and that his company would develop the water power in the region without flooding the lakes of Cook County.

Recent Court Decisions

MAINTAINER OF DEFECTIVE 110-VOLT SERVICE WIRE RESPONSIBLE FOR DEATH DUE TO CONTACT WITH IT.—In Van Leet vs. Kilmer the plaintiff's husband fell from a ladder on which he was working and received fatal injuries. The reason for his fall was alleged to be a shock from the defendant's defectively insulated 110-volt service wire when a wire with which the dead man was working came into contact with it. A verdict of $26,000 was sustained as not excessive by the New York Supreme Court, which said: "The exercise of reasonable prudence would have led defendant to anticipate that workmen might have occasion to come in proximity to these wires and that the insulation should be kept in good repair by installing new wires if necessary." (232 N.Y.S. 330.)*

UTILITY COMPANY FORBIDDEN TO UNDERBID MUNICIPAL PLANT.—The town of Mapleton, Iowa, successfully prosecuted its action against the Iowa Public Service Company in the Iowa Supreme Court, when that court sustained a lower tribunal's restraining order against the private company directing it to charge no less than the rate fixed by ordinance and charged by the municipally owned plant. Two members of the court dissented from the majority opinion, which assailed privately owned utilities for starting price wars in the guise of competition. "Public utilities operated by municipalities may be at the mercy of privately owned utilities if a price war is started," the opinion said. "A public utility has no constitutional right of competition. A rate war is not competition. It might be, and usually is, a fight which bodes nothing to the public but disorder and disorganization." The court directed the Iowa Public Service Company not only to raise its rate to the tariff specified by the city ordinance, but to impose its five-dollar meter deposit charge as well.

*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

Commission Rulings

ELECTRICAL CUSTOMERS MUST NOT BE SADDLED WITH COSTS OF STEAM-HEATING SERVICE.—Granting the Illinois Power & Light Corporation increased rates for steam-heating service at Mount Vernon, Ill., where the local generation of electricity has given way to service over the company's high-tension lines, the Illinois Commerce Commission, noting that this development in the interest of economy has necessarily made it unprofitable to supply steam heat at the same rate as when it was a byproduct, said: "The principle is well established that each utility service in a community shall, so far as possible, pay its own way, and the utility company in the determination of its electric and heating rates is not justified nor will it be permitted to impose on the electric consumers as a group any part of the burden of expense of maintaining and operating the heating system."

REQUIRING OF DEPOSIT FROM NEW CUSTOMER REASONABLE.—The Public Utilities Commission of the District of Columbia has determined that where those applying for service have not established their financial reliability the Potomac Electric Power Company has been justified in insisting on a deposit, although no ruling in this matter was ever previously made by the commission. "Losses due to uncollectible bills," the commission says, "are treated as a deduction in determining the amount available to pay a return on the value of the property of the utilities; consequently, those who pay their bills in effect also pay the bills of those who fail to pay. It is, therefore, in the public interest that losses on bad accounts by utilities be held to a minimum. Guarantee against any such losses is only provided by full prepayment, but in the case of metered or measured service such prepayment is difficult to carry into effect and would be more of an inconvenience that the payment of a deposit as a condition to giving service." The commission then made the following rule: "Applicants for service shall be required to make a deposit unless they establish their credit to the satisfaction of the company. The amount of the deposit required shall not exceed the estimated bill for two months' service except that where such an amount is less than $5 the deposit shall be $5."

News About Men of the Industry

K. P. Applegate General Manager in Hartford

K. P. Applegate, formerly purchasing agent of the Connecticut Power Company and the Manchester Electric Light Company, has been appointed general manager of the Hartford Electric Light Company. Following graduation from the Rensselaer Polytechnic Institute in 1912 he entered the engineering department of the Hartford Electric Light Company, remaining in that department until 1914, when he was transferred to the sales department as power sales engineer. Two years later he was appointed purchasing agent of the Hartford Electric Light Company and subsequently he assumed similar duties with the Connecticut Power Company and the Manchester Electric Light Company. Mr. Applegate is a member of the American Institute of Electrical Engineers, the National Association of Purchasing Agents and other similar organizations.

CLARENCE L. LAW is now general commercial manager of the New York Edison Company, having been promoted from his previous position as acting general commercial manager.

GEORGE P. URBAN was elected a director of the Buffalo General Electric Company at the stockholders' meeting held January 21. Mr. Urban takes the place on the directorate made vacant by the death of his father, George Urban, Jr., a year ago.

DE WITT C. SCOTT has been appointed manager of the San Joaquin district of the San Joaquin Light & Power Corporation, to succeed E. G. Stahl, who has assumed new duties. Mr. Scott entered the employ of the San Joaquin utility in 1919 and since that time he has engaged in both engineering and sales work.

K. F. DICKINSON, who has been manager for the Northern Indiana Power Company at Huntington, Ind., for the last two years, has been transferred to Lafayette, Ind., as general manager of the company's properties in that district. His place at Huntington will be taken by Paul McLeod of Lafayette, who has been superintendent of the power plant in that city.

A. A. POPE, assistant general commercial manager of the New York Edison Company, has retired after 40 years of service. Mr. Pope was a pioneer in the company and had long been a leader in its affairs. The beginning of his career was with the Edison Electric Illuminating Company of Brooklyn in 1889, but in one year he had removed to New York, and later was one of the four men who started the contract and inspection department. In addition to handling important contact matters with the public Mr. Pope was active in the early movement culminating in the present National Electrical Code, which resulted in a better understanding between the electrical industry and the insurance interests. Mr. Pope also has the honor of being one of the ten men who met to organize the Illuminating Engineering Society. He is a member of the Edison Pioneers and other engineering organizations.

GUIDO SEMENZA of Milan, Italy, formerly president of the International Electrotechnical Commission, and known in all parts of the world as an eminent electrical engineer, has been made the eighth recipient of the Faraday medal. This medal is awarded by the

Guido Semenza

British Institution of Electrical Engineers not more frequently than once a year for either notable scientific or industrial achievement in electrical engineering or for conspicuous service to the advancement of electrical science, without restriction as regards nationality or membership of the Institution.

HARRY B. STEARNS of the power engineering department of the Cambridge Electric Light Company has joined the commercial department of the New England Power Association, with headquarters in Boston, Mass. Mr. Stearns will be occupied with industrial power activities under Hugo Rocktashel, manager of wholesale power sales. He is well known in the New England central-station field, being secretary of the New England Association of Central-Station Power Engineers and a member of the Massachusetts bar. He was graduated in electrical engineering from Brown University in 1909, and after several years with the General Electric Company at Schenectady, Pittsfield and Lynn, spent about five years as power engineer in the field for C. D. Parker & Company, Boston. He has been with the Cambridge company since the spring of 1921.

NELSON L. MANTER of Wayne, Me., has been appointed farm service engineer for the Central Maine Power Company. Mr. Manter is a graduate of the University of Maine.

JERRY SMITH, who for many years was superintendent of the Boonville Electric Light & Power Company, Boonville, Ind., recently acquired by the Southern Indiana Gas & Electric Company, has been appointed general manager of the Boonville office under the new management.

S. I. MCELHOES has been promoted by the Southwestern Light & Power Company to be vice-president of that organization, which has its headquarters at Oklahoma City. Mr. McElhoes was formerly chief counsel of the company and had his home at Lawton, Okla. He has been an active factor in building up the company's properties, not confining his services to those of a legal nature.

E. H. KIFER, vice-president and general manager of the San Antonio Public Service Company, San Antonio, Tex., has been elected president of the San Antonio Chamber of Commerce. For the past ten years Mr. Kifer has taken a leading part in that city's commercial and civic life. His executive duties with the utility company have not kept him from serving in the public welfare. He has also been prominent in association work, being a past-president of the Southwestern Division of the National Electric Light Association.

BARNEY G. TANG, assistant general superintendent of the Schenectady Works of the General Electric Company, has been made general superintendent to succeed the late James A. Smith. JOHN D. HARNDEN, former superintendent of the testing department, has been appointed assistant to the works manager, F. L. KEMP succeeding him as superintendent of the testing department, and LEROY BEERS has been made plant engineer, a newly created position under the works manager. Mr. Tang entered the Schenectady Works in 1898.

V. M. MCDONALD, for 22 years connected with the Public Service Company of Colorado in various capacities, has been appointed manager of the Leadville district to succeed E. L. Seikmann, resigned. Mr. McDonald first entered the employ of the predecessors of the Public Service Company of Colorado in 1906, when he was made city foreman of the old Leadville Light & Power Company. He served there for six years and then removed to Denver, where for a number of years he was connected with the Central Colorado Power Company in charge of power line transmission. That company later became the Colorado Power Company and was subsequently absorbed by the

Public Service Company of Colorado. During the past few years Mr. McDonald has been in charge of high-tension electric lines.

A. R. McDonald, Madison, Wis., has been reappointed by Governor Walter J. Kohler to serve a new six-year term as a member of the Wisconsin Railroad Commission. Mr. McDonald was first appointed to the commission in May, 1923, by ex-Governor John J. Blaine. Prior to his connection with the commission he was for 23 years actively engaged in railroad work.

Andrew J. Leib has been appointed district representative of the Luzerne County Gas & Electric Corporation at Hazleton, Pa., to succeed H. S. Dutton, Jr., resigned. Mr. Leib has been in the employ of the Luzerne company since the fall of 1915 with the exception of a year spent in military service. His first position was in the capacity of meter reader. Later he became salesman and eight years ago was appointed sales manager at Hazleton, the position he occupied until his recent appointment.

W. H. Barnwell became connected with the Georgia Power Company on February 1 and will act as a field representative in the new industries division. Before entering the employ of the Georgia Power Company Mr. Barnwell was connected for eight years with the Lockwood-Greene Company in the Atlanta office and prior to that was for eight years with Grinnell Company, Inc., as contract engineer and manager of the Atlanta office. He is a graduate of Clemson (S. C.) Agricultural and Mechanical College.

George A. Wieber, for the past nine years manager of industrial sales for the Utica Gas & Electric Company, has been appointed to the same position with the New York Power & Light Corporation. With headquarters at Albany, he has charge at the central office of all tests, reports and negotiations dealing with the requirements of larger power customers. Mr. Wieber is a graduate of the Brooklyn Polytechnic Institute and before his association with the Utica company was connected with the Westinghouse Electric & Manufacturing Company at East Pittsburgh and with the New York Edison Company.

C. E. Torrey, general manager of the Ohio Power Company (a subsidiary of the American Gas & Electric Company), with headquarters at Canton, Ohio, has been appointed general manager of the Zanesville property, recently acquired by the American Gas & Electric Company. At the same time Mr. Torrey will continue in his former capacity. Direct supervision of the company will be carried on by E. T. Wagenhals, division manager, from his office at Newark, Ohio. A. M. Plummer, formerly district superintendent of the Ohio Power Company at Lancaster, Ohio, has been transferred to Zanesville as manager of the light and power department of the Southern Ohio Public Service Company.

A. Penn Denton, engineering director of the armored conductor and flexible metallic conduit section of the National Electrical Manufacturers' Association, has just returned from a tour of ten Western cities where he addressed all electrical groups interested in national code development. Mr. Denton's trip took him to Denver, Salt Lake City, Spokane, Vancouver, Seattle, Portland, San Francisco, Los Angeles, Oakland and San Diego.

R. M. Heskett a Director of National Bank

Rolland M. Heskett, manager executive of several power and utilities companies, has been elected to the board of directors of the Northwestern National Bank at Minneapolis. Mr. Heskett formerly was connected with the Minnesota Utilities Company in the Superior (Wis.) iron range district.

R. M. Heskett

He removed to Minneapolis in 1923 and is now vice-president, treasurer and managing executive of the Minnesota Northern Power Company, the Montana-Dakota Power Company, the Black Hills Utilities Company and the Gas Development Company. General offices of these companies, which are associated through ownership or majority control, are in Minneapolis, with corporate offices in Wausau, Wis. The Minnesota Northern Power Company is a holding corporation. The Montana-Dakota Power Company is now supplying 83 towns in eastern Montana and western North Dakota with electric light and power.

O. Needham, formerly section engineer in charge of steel-mill engineering of the Westinghouse Electric & Manufacturing Company, has been appointed assistant superintendent of the testing department of the East Pittsburgh Works of the company. William Shirk will replace Mr. Needham as section engineer. Mr. Needham's connection with the general engineering department dates from 1919, during which time he has been engaged upon the calculation of motor sizes and the application of electricity to steel mills. Since 1926 he has been section engineer in charge of steel-mill engineering. Mr. Needham is a member of the American Institute of Electrical Engineers, the Association of Iron and Steel Electrical Engineers and other organizations.

T. D. Scarff has been appointed assistant general manager of the Chicago office of the National Lamp Works of the General Electric Company. Mr. Scarff was transferred to Chicago two years ago to take charge of the lamp business of the Middle West Utilities Company after having been for a number of years with the Buckeye division of the National Lamp Works.

A. G. Bissell, welding engineer for the Westinghouse Electric & Manufacturing Company, recently resigned to enter the industrial field as an independent consultant in arc-welding engineering on the Pacific Coast. Mr. Bissell is a graduate of the University of Washington. His entire career has been spent in the arc-welding industry. Prior to entering the employ of the Westinghouse interests in 1923, Mr. Bissell was arc-welding metallurgist at the Puget Sound Navy Yard, arc-welding engineer for the Boeing Airplane Company, Seattle, Wash., and superintendent and engineer of the Arc-Weld Furnace Company, Seattle.

Obituary

P. L. Griffith, engineer for the Electric Bond & Share Company on most of its work in foreign countries, died at his home in Montclair, N. J., on February 25 from influenza. Mr. Griffith was formerly connected with the Pearson organization, and his knowledge of Spanish coupled with his engineering experience in Latin countries was of inestimable value to the Bond & Share company when it branched out in Central and South America.

Andrew A. Cavanaugh, treasurer of the Wisconsin properties of the Northern States Power Company, died in Minneapolis on February 20 at the age of 37. Mr. Cavanaugh was born in Wisconsin, but was a resident of Minneapolis for 25 years. He entered the employ of the Northern States company shortly before the world war and returned to it after service abroad. In 1924 he was transferred to Eau Claire, Wis., as treasurer.

Paul W. Barnes, distribution engineer of the Ohio Power Company, Coshocton, died December 29 at Akron, after a brief illness. Mr. Barnes entered the employ of the Ohio Power Company about four years ago, and after serving as distribution clerk for one year he resigned to remove to Chicago, when he became identified with Montgomery & Ward. He returned to Coshocton in the summer of 1926 as distribution engineer. Mr. Barnes was 29 years of age.

Financial and Statistical News

Uncertainty Exists in Securities Markets

MARKET operators are at a loss these days to detect any definite trend in either direction. After the two-day holiday the way seemed cleared for an advance, but higher money rates changed the situation somewhat and advances are about equaled by losses. Month-end settlements led to the calling of loans on a fairly large scale. It is understood, however, that brokers' requirements are smaller, due partly to the liquidation that has taken place and partly to the increased margin requirements demanded.

There are indications that much more attention is being paid to the general credit situation than was the case until recently. The recent Federal Reserve statement showing a drop in investment holdings reflects the stand being taken by the Reserve system to check speculation.

The public utility stocks have made no definite movement in either direction. Gains and losses are about evenly divided. Only one new issue was placed on the market this week.

Kelvinator Corporation Shows Smaller Loss

The Kelvinator Corporation and subsidiaries showed a net loss of $999,821 for the year ended September 30, 1928, against a net loss of $2,467,248 for the previous year. Total assets as of September 30 last were $15,922,400. The consolidated income account for the two periods is as shown in the accompanying table.

	*Year Ended Sept. 30, 1928	Year Ended Sept. 30, 1927
Net sales	$18,120,602	$20,122,865
Costs	17,921,116	21,534,570
Operating profit	$199,486	‡$1,411,705
†Other deductions	1,032,591	879,463
Loss	$833,105	$2,291,168
Interest	166,716	176,080
Net loss	$999,821	$2,467,248

*Includes operations of Kelvinator, Leonard, Nizer and Carrier divisions, but does not include profit of Refrigeration Discount Corporation. (100 per cent owned), Kelvinator of Canada, Ltd., or Kelvinator-Chicago Company.
†Other deductions less other income. ‡Loss.

15,000,000 Hydraulic Hp. on Public Domain

Out of a total of nearly 13,000,000 hydraulic horsepower now developed in the United States more than 4,500,000 hp., is developed on public lands or navigable streams, under authorization of the federal government. The potential power of the water-power development that would affect government land is estimated at 15,000,000 hp.

On the public domain there are 30,000,000 acres of coal lands which contain 200,000,000,000 tons of fuel for the future, half a million acres of phosphate land that can supply 8,000,000,000 tons of this essential fertilizer as its need on American farms is better realized, an undetermined acreage of potash deposit, the best of which yet discovered are on public lands. There are 65 developed oil and gas fields with an annual production of 33,000,000 bbl. of oil and 4,000,000 acres of oil shale from which possibly 60,000,000,000 bbl. of oil can be extracted when high prices arrive to warrant the higher cost.

These examples of latent values still remaining under government control are cited in a recent statement issued by the Department of the Interior.

Utility Companies Call Securities

All of the outstanding first mortgage sinking fund 6 per cent gold bonds of the Eastern Montana Light & Power Company were recently called for redemption as of January 1, 1929, at 101 and interest. The Indiana Light & Power Company has called for payment all of the outstanding first lien collateral trust 6 per cent gold bonds as of January 2, 1929, at 105 and interest and the Kentucky Hydro Electric Company has called for redemption June 1 at 104 and interest all of the outstanding first mortgage gold bonds, series A, dated June 2, 1924, and maturing June 1, 1949.

Public Utility Earnings Not Excessive

That the earnings of the utility industry as a whole and of one utility group in particular are not excessive is proved by the accompanying tables presented by W. J. Hagenah, vice-president of the Byllesby Engineering & Management Corporation, to a 1928 interim committee of the Wisconsin State Legislature. The committee was inquiring into electric utility operations and practices in the state in response, primarily, to government ownership agitation.

German Public Utilities Borrow Heavily

Recent figures concerning the amount of foreign loans placed by Germany during 1928 indicate how rapidly its public utilities industry is developing, according to the Department of Commerce. During the year ended December 31, 1928, twelve important foreign loans amounting to 357,000,000 marks were obtained by German electric public utility companies. Ten of these loans, amounting to 292,000,000 marks, were placed in the United States. One loan of 50,000,000 Swiss francs was obtained from Switzerland and another loan of £1,200,000 was placed in England.

Almost a quarter of Germany's foreign loans have been obtained for its utilities, notwithstanding the fact that a large part of municipal loans also have been used for improving municipal power plants.

Central Light and Power Plants in Chile

Information regarding electric service in 176 communities in Chile is contained in special circular No. 579 of the Electric Equipment Division, Bureau of Foreign and Domestic Commerce, of the U. S. Department of Commerce. The tabulation includes the capacity of prime movers in horsepower, generator capacity in kilowatts, type and voltage of secondary distribution and type of prime mover.

Many of the plants are quite small, judged by standards prevailing in the United States, and plant details are lacking in many instances. The omissions may be taken to indicate the difficulty of securing this type of information. Data on distribution systems are

Thirty Leading Utility Properties

Year	Book Value of Physical Property	Gross Earnings	Net Earnings (Before Depreciation)	Earned for Depreciation and Returns on Book Value, Per Cent
1923	$4,279,591,180	$908,315,587	$344,169,491	8.0
1924	4,911,521,552	993,191,055	374,698,806	7.6
1925	6,491,894,685	1,219,483,559	491,089,611	7.6
1926	7,520,503,671	1,407,067,149	587,999,468	7.8

Standard Gas & Electric Company—Utility Properties

Year	Total Capitalization	Physical Property	Net Earnings*	Per Cent Earned* on Capitalization	Per Cent Earned* on Physical Property
1923	$290,021,008	$262,026,202	$18,710,482	6.45	7.14
1924	329,540,589	296,769,645	21,455,131	6.51	7.23
1925	696,380,559	717,835,010	55,577,371	7.98	7.74
1926	754,295,313	812,360,454	61,645,634	8.17	7.60
1927	709,596,151	823,412,594	63,145,164	8.90	7.67

*Before deducting depreciation.

notably complete. The predominant voltage is 220, combined usually with 440 or 660; direct current is more common than alternating; for the latter the prevailing frequency is 50 cycles; steam, hydro, crude oil, gasoline, gas and Diesel engines are reported under "Class of Plants."

Hydro-Electric Progress in Canada During 1928

That the year 1928 was one of the greatest in the history of water-power development throughout the Dominion is disclosed in the annual review of hydro-electric progress by the Dominion Water Power and Reclamation Service of the Department of the Interior.

During the year the water wheels or turbines actually installed and brought into operation totaled slightly more than 550,000 horsepower, bringing the total installation in the whole Dominion to a figure of 5,328,000 hp. Additional to this large increase there were many large undertakings under active construction, some of which were nearing completion at the end of the year while others were in their initial stages. The combined installations of these projects total to more than 1,200,000 hp. There are also many large developments in prospect, a number of which will undoubtedly be undertaken in the coming year.

The effect upon the country's prosperity of this great program of construction work is evident when it is stated that for the actual development, transmission and distribution of the new power capacity installed in 1928, together with that at present actively under construction, not less than $330,000,000 will be required. Moreover, it has been estimated, says the review, that for every dollar so expended six dollars are required to apply this power to its ultimate uses so that on this basis, a total expenditure of probably $2,300,000,000 will result throughout the Dominion as a result of this new development.

During 1928 every province was represented in the year's activities and, while Quebec stood first in works of magnitude, the widespread nature of development is perhaps the most interesting and significant feature. Saskatchewan appears for the first time with a hydro-electric project under way on the Churchill River for the supply of the new northern mining area, while British Columbia, Alberta, Manitoba, Ontario and the Maritime Provinces are all represented with important new undertakings or substantial additions to existing developments.

The principal activities in each of the provinces are given in some detail in the review. A list of Canadian hydro-electric plants completed in 1928 or planned for an early start was published in the ELECTRICAL WORLD of January 5, 1929, on page 59.

Brooklyn Edison Report Shows Sales Up 10 per Cent

WITH an increase of only 4.2 per cent in operating costs for the year ended December 31, 1928, over the previous year and an 8.5 per cent increase in gross revenue, the Brooklyn Edison Company has been able to show a growth of 16.6 per cent in net revenue or gross corporate income. The gross revenue total was $40,360,455, against $37,198,758.

The growth of energy sales by the company during the past few years has been steady and rapid. The 1928 figures of 832,733,367 kw.-hr. is an increase of 10.3 per cent over that of the previous year. The total has grown from 500,652,744 in 1924, which is an increase of 66 per cent over the four-year period. During the year the company had a net gain of 46,942 connected meters, making the total 791,265.

In its annual report the company showed an interesting tabulation, bringing out the distribution of revenue in various directions. Taxes took 12.31 per cent and operating expenses 43.21 per cent. Of the latter amount wages accounted for over 25 per cent. Interest requirements took 6.18 per cent and dividends 17.84 per cent. Retirement reserve was 8.16 per cent, continguency reserve approximately 2 per cent and surplus 8.74 per cent.

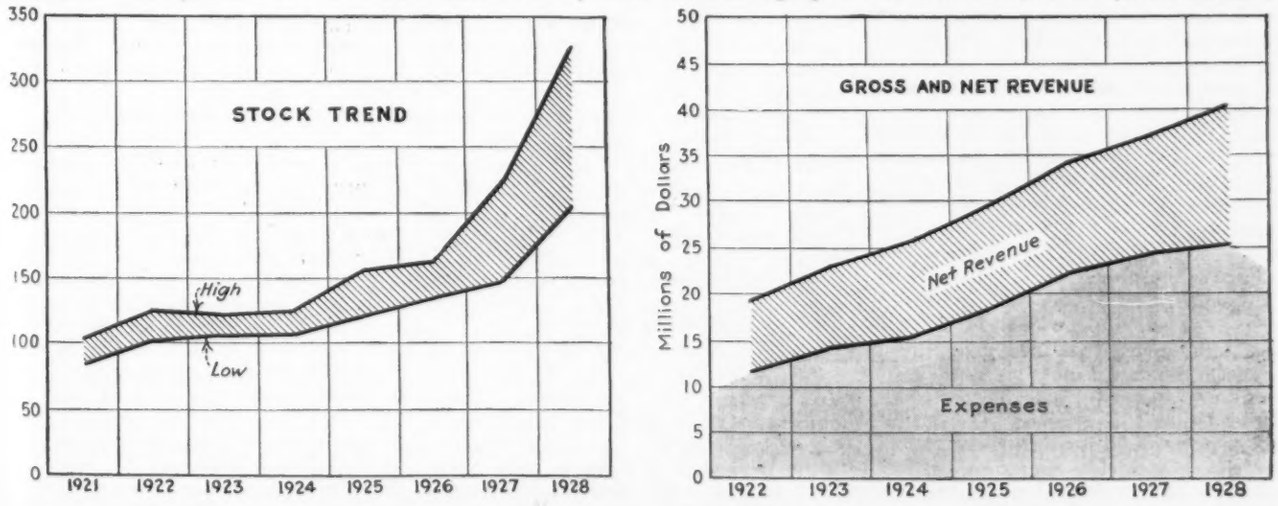
The common stock of the Brooklyn Edison Company has had a rapid rise during the past two years. Earnings per share five years ago were slightly under $10 and the market price averaged about ten times earnings at that time. By 1927 the earnings per share had increased to $10.33 and the 1927 average price of $186 is approximately eighteen times earnings. Negotiations entered into with the Consolidated Gas Company of New York for acquisition of the Brooklyn Edison Company were accompanied by a rise in the company's stock to as high a price as $325. This is approximately 26 times last year's earnings of $12.51 and the figures indicate the high valuation which the market placed upon the company's stock.

ASSETS INCREASE SIX MILLIONS DURING THE YEAR

Total assets aggregated $176,874,221 at the close of 1928, being some $6,000,000 greater than the total shown at the end of 1927. The outstanding changes in the assets are an increase of approximately $14,000,000 in plant, a decrease of over $7,000,000 in cash and a decrease of a little over $800,000 in investment in miscellaneous assets.

The important changes in liabilities are an increase of approximately $1,200,000 in retirement reserve, an increase of $800,000 in the contingency reserve and an increase of over $3,500,000 in the profit and loss surplus.

ENGINEERS PUBLIC SERVICE TO ISSUE SHARES TO STOCKHOLDERS.—Engineers Public Service Company has authorized the sale to its stockholders of approximately 200,000 shares of additional common stock at $42.50 per share. Common-stock holders and $5.50 cumulative



Price trend of Brooklyn Edison common stock since 1921 and distribution of revenue and expenses

preferred-stock holders will receive rights to subscribe for one new common share for each ten shares held, convertible preferred-stock holders 1½ shares common for each ten shares held and option warrant holders one share common for each twenty warrants held, all applicable to record holders as of February 14. The proceeds of the issue will be used for further investment in the company's subsidiaries, thus supplying a part of their 1929 construction requirements.

Electrification Conserves Coal Supply

The use of electricity has contributed to bring about a decrease in the consumption of coal by the manufacturing industries, according to data compiled in connection with a study of the probable requirements of the bituminous industry during the year.

There are 22 large coal-consuming industries, of which cotton textiles is typical, that use coal chiefly for power. In 1909 these "power" industries consumed 16,700,000 tons. During the following ten years consumption increased, rising to 19,100,000 tons in 1919. After the war, however, with the rapid substitution of electric power from central stations, their requirements have fallen to less than 15,000,000 tons, notwithstanding a general increase in the value and quantity of manufactured products and a rise in the installed horsepower from less than 30,000,000 in 1919 to 40,000,000 in 1928.

The electric utilities are using more coal, but the consumption is increasing far less rapidly than the energy output from fuel-burning plants. Twenty years ago they required 20,000,000 tons. In 1919 they used 35,100,000 tons; at present they are taking 42,000,000 tons.

In contrast with this rather moderate increase, particularly during the past decade, is the growth in the amount of energy generated from fuel—not over 9,000,000,000 kw.-hr. in 1909, 24,300,000,000 kw.-hr. in 1919 and nearly 53,000,000,000 kw.-hr. in 1928.

The industries that generate their own power and use either direct mechanical or electrical drive have shared in the progress. Since 1919 the mechanical prime movers have remained nearly constant, but of their 20,000,000 hp. about half is now applied electrically. Meanwhile, the horsepower of motors driven on purchased energy has risen from 10,000,000 to 19,000,000. From both aspects electrification has aided fuel conservation.

The railroads, which use 28 per cent of the output, are burning 14 per cent less bituminous coal and handling 9 per cent more business than they did ten years ago. A small amount of the decrease in coal consumed is due to fuel oil and an additional amount to the increase in electrical operation, but most of it is ascribed to higher fuel efficiency.

On the other hand, a group of 32 "heat" industries, using fuel primarily for the direct application of heat, have kept on increasing the amount of coal consumed—41,000,000 tons in 1909, 54,000,000 in 1919 and 60,000,000 tons at present. The iron and steel industry shows an actual decline in the consumption of coal.

Combining all uses, consumption of bituminous coal in the United States during 1929 is likely to be somewhere between 500,000,000 tons and 510,000,000 tons. It is not considered likely to reach the 532,000,000 tons attained in 1926, but will more probably be about the same as in 1927, when it aggregated 499,000,000 tons, or in 1928, when it was apparently slightly less.

Pacific Public Service Company Sells Bond Issue

The Pacific Public Service Company this week sold a $5,000,000 issue of 6 per cent fifteen-year convertible gold bonds.

The Coast Counties Gas & Electric Company, of which the Pacific Public Service Company owns 99 per cent of the common stock, with the California Consolidated Water Company and the California Consumers Company, which are owned in their entirety, supply electric light and power, manufactured gas, distilled water, manufactured ice, cold storage and refrigeration to more than 60 communities in northern and southern California.

$50,000,000 for Expansion in Michigan

The plans of utilities in Michigan call for the expenditure of between $45,000,000 and $50,000,000 in additional generating facilities, extensions and improvements, according to estimates tabulated by the Michigan Public Utility Information Bureau. The program of progress mapped out for 1929 breaks all electric power records for the state in magnitude of appropriations.

In Michigan, where more than half the electric power output is used in industry, power demand may be considered as a barometer of industrial economic and even social conditions. This barometer has been rising steadily during the past year, particularly during the past six months. Indications for 1929 are highly favorable.

The utilities, which naturally are close observers of the power demand barometer, are showing their confidence in the state's industrial and economic strength, present and future, by making budget plans to provide greatly increased electric power resources for the state in 1929.

As a result of enlarged capacities, production may be expected to increase in 1929 by approximately 485,000,000 kw.-hr., according to the bureau. Added facilities will permit the companies to take care of 68,000 more customers—the anticipated growth—as well as to serve efficiently the expanding needs of present customers, numbering close to 1,031,000.

Use of electric power on the farm grew rapidly in some of the older sections of the state in 1928. Expansions along this line figure in the budget plans of various companies.

Michigan relies upon coal rather than upon water power for the bulk of its electric power supply. In 1928, of the approximate total of 4,361,842,000 kw.-hr., 3,218,040,000 kw.-hr., or 73.8 per cent, was produced by fuels, while 1,143,397,000 kw.-hr., or 26.2 per cent, was produced by water power. These figures are taken from the United States Geological Survey monthly reports, with December estimated. The year 1928 was an even better water power year than 1927, which was above the average for the past decade.

Indications are that steam-turbine capacities added in 1929 will overbalance the gains in new hydro-turbine capacities. Judging by the record of the past, this overbalancing will grow greater from now on, because Michigan's potential undeveloped water powers are limited in their practical capacities, while the demand for electric power at present appears unlimited.

Energy production went far beyond all previous records in 1928. The gain of approximately 628,914,000 kw.-hr., or 16.6 per cent, is the greatest ever made in the state in a corresponding twelvemonth period. The new total marks the doubling of Michigan's electric power resources in the seven-year period since 1922, when the entire output of the state's electric utilities was 2,179,944,000 kw.-hr.

RECENT LISTINGS.—The New York Stock Exchange has authorized the listing of additional refunding and first mortgage gold bonds, series B, due June 1, 1961, of the Milwaukee Electric Railway & Light Company to the amount of $10,000,000. This makes the total amount applied for to date $39,119,000. The New York Stock Exchange has also authorized the listing of 26,000 additional shares of common stock (par $100) of the Allis-Chalmers Manufacturing Company, making the total amount applied for 286,000 shares.

ANACONDA COPPER INCREASES DIVIDEND RATE AGAIN.—The Anaconda Copper Company will pay a quarterly dividend of $1.75 on its $50 par value capital stock on May 20, placing the stock on a $7 annual basis, or 14 per cent, against $3 annually paid from 1925 to 1927. The present increase in dividend rate is the third in less than a year. In February and May, 1928, quarterly dividends of 75 cents were paid, while in August and November the rate was $1. On December 24, 1928, the directors declared a quarterly dividend of $1.50, payable February 18, advancing the annual rate from $4 to $6 a share, and last week another dollar was added to the annual return upon the stock.

Business News and Market Conditions

Aluminum Found Suitable for Screw Shells

AS A RESULT of an elaborate test recently conducted by the Underwriters' Laboratories aluminum is declared to be the equivalent of "Gilder's metal," copper or brass for use in the production of screw shells, according to the Aluminum Company of America. This means that aluminum is acceptable for use in wiring supplies, including male and female screw shells.

For many years copper and brass and other copper zinc alloys have been generally accepted by the Underwriters' Laboratories for current-carrying parts in wiring supplies. About two years ago the Aluminum Company of America brought before the Underwriters' Laboratories the question of screw shells made from a special aluminum alloy and subsequently submitted this material for investigation. The following points were considered: Facility of manufacture, uniformity of product, mechanical strength, rigidity, conductivity, effect of heat, effect of continuous operation and resistance to corrosion.

This alloy in sheet form, as disclosed in the experiments, can be readily drawn into cup-shaped pieces and Edison base threads can be rolled in without introducing undue strain or fractures at edges or other points where the metal is distorted. In uniformity the product is equivalent to the screw shells formed from "Gilder's metal," as well as in rigidity and mechanical strength. Shells formed from both kinds of material could be crushed readily with little or no apparent difference in the amount of pressure required. Caused to carry continuously a current of 30 amp., aluminum screw shells assembled in plug fuse cutout bases and holding dummy fuses were found after a period of two hours to register no temperature rise. Furthermore, three samples of the screw shells were assembled in medium base sockets, supplied with a 300-watt lamp and operated continuously for a period of six weeks, after which time no difference was found between the samples tested and the new ones. They showed no tendency to crack or anneal.

In another test three samples in which the aluminum screw shells had been assembled in medium base sockets were subjected to a test to determine the effects of heating from a lamp. The metal-inclosing shell of the interior was cut away sufficiently to allow the insertion of a thermometer directly against these aluminum screw shells and a 300-watt lamp was inserted in each screw shell and operated until constant temperatures were recorded. The temperature obtained on the screw shells was 78 deg. C. at a room temperature of 71 deg. C. At the end of a definite period the shells were found to show no change. Six samples were then placed in a moist air tank for a period of ten weeks in an attempt to corrode the samples, but at the end of the period no corrosion had taken place.

The sheet metal is furnished in sheets 0.013 in. in thickness (Number 28 U. S. gage) to manufacturers of wiring supplies and others fabricating Edison male and female screw shells for use in lamp holders, cutout bases, attachment plugs, current taps, etc. The temper known as 25 SO is the hardest and strongest variety.

The Aluminum Company of America advises that the composition of this alloy is in accordance with the formula: Copper, 3.9, 5 per cent; manganese, 0.5, 1.0 per cent; silicon, 0.5, 1.0 per cent; the remainder, aluminum.

Delinquent Electrical Accounts

(Data Supplied by National Electrical Credit Association)

Division	January 1928	January 1929	Per Cent Increase or Decrease	Twelve Months 1927–8	Twelve Months 1928–9	Per Cent Increase or Decrease
New York	260	198	—23.8	3,508	3,407	—13.1
Middle and Southern Atlantic	159	134	—15.7	2,021	2,177	+ 7.7
New England	133	111	—16.6	1,884	1,569	—16.7
Pacific Coast	11	19	+72.7	222	147	—33.8
Central	798	594	—25.8	10,555	28,560	—18.9
Total	1,361	1,056	—22.4	18,190	15,500	—14.8

TOTAL AMOUNTS REPORTED

	January 1928	January 1929	Per Cent Increase or Decrease	Twelve Months 1927–28	Twelve Months 1928–29	Per Cent Increase or Decrease
New York	$49,527	$36,930	—25.4	$552,454	$449,304	—19.6
Middle and Southern Atlantic	17,511	14,836	—15.3	239,255	281,195	+17.5
New England	14,774	10,925	—26.1	225,462	195,551	—13.3
Pacific Coast	1,933	6,776	—250.5	22,311	23,872	—12.6
Central	100,755	61,980	—38.5	1,204,277	1,011,041	—16
Total	$184,500	$131,447	—28.8	$2,248,759	$1,960,963	—12.8

One Hundred per Cent Rise in Engineering Contracts

Engineering contracts reported awarded in January total $396,833,000. This is at the rate of $79,500,000 per week, which is 60 per cent higher than in January, 1928, and 34 per cent higher than in December, according to the *Engineering News-Record*.

Industrial buildings show an unusually large increase, the total for the month amounting to 22 per cent of the value in the whole of 1928. The explanation is a $45,000,000 oil refinery at Mariners Harbor, N. Y., to be built by the Gulf Refining Company.

The unclassified division is also high, helped by a $45,000,000 telephone extension in Missouri for the Southern Bell Telephone Company.

Value of Contracts by Sections in the United States and Total for Canada, January, 1929

Thousands of dollars (-000) omitted

	New England	Middle Atlantic	South	Middle West	West of Mississippi	Far West	United States Jan., 1929	United States Jan., 1928	Canada
Water-works	$116	$443	$15	$1,362	$801	$64	$2,801	$2,147	$73
Sewers	52	2,016	538	1,964	1,306	403	6,279	3,071	477
Bridges	.....	797	2,322	1,352	3,046	151	7,668	4,661	.....
Excavations, drainage, etc	.....	317	416	1,423	8,807	94	11,057	2,979	27
Streets and roads	908	3,394	5,954	3,844	12,247	4,833	31,180	26,781	340
Industrial buildings	2,150	56,874	1,098	11,086	1,840	4,600	77,648	21,015	1,490
Commercial buildings	23,566	69,800	9,064	22,229	11,772	13,034	149,465	95,993	7,350
Federal government	34	6,508	1,214	492	89	205	8,542	5,615	.....
Unclassified	247	16,209	332	8,559	60,669	16,177	102,193	35,722	1,490
January, 1929	$27,073	$156,358	$20,953	$52,311	$100,577	$39,561	$396,833	$197,984	$11,247
December, 1928	13,273	66,640	24,051	51,210	53,550	28,373	237,097	.....	20,829
January, 1928	17,340	72,804	19,077	40,280	31,681	16,802	197,984	.....	12,575

Market Conditions

INDUSTRIAL and central-station demand for electrical equipment continues well above average in the Eastern district. Orders for transformers, switching equipment, etc., have been substantial.

Business in the Southeast is still limited, but some good orders are reported pending.

Power equipment orders for New England's mills and plants are well above average.

From the Middle West come reports of some substantial equipment orders, but business on the whole in these lines is just about average. A big building program is anticipated in the St. Louis area.

Pacific Coast business this week is more or less limited to staples. The Puget Sound district reports demand from industrial sources decidedly limited.

Substation Equipment Active in Eastern District

Considerable interest is centered in substation equipment in the Eastern district market, with excellent turnover of transformers, circuit breakers, switching equipment and auxiliary apparatus. Central-station and industrial business is quite evenly divided, with an excellent outlook for continuance of high level transactions. A power company in southern New Jersey has given an order to a New York maker for transformers to cost $110,000. A metropolitan utility company has contracted for similar equipment to an amount of $200,000. A New York power interest has placed a commitment for substation transformers to cost $60,000 and another order for oil circuit breakers to the sum of $75,000. In connection with prime movers, a Pennsylvania manufacturer has received an order from a municipality in Texas for a 7,500-kw. turbo-generator unit and condenser at a price of $152,000. A power company in Kentucky has ordered a 90-kva. generator, direct-connected to an engine unit, for an ice plant installation, as well as an alternator and kindred equipment. A Virginia central station has contracted with a New York maker for a condenser to cost $65,000.

Heavy industrial motors are in fine demand. A brass company in Connecticut has ordered a number of synchronous motors to cost $35,000, and a manufacturer of compressors in the same district has placed a commitment for motors and controls to a like sum. A maker of switches says that printing plants are placing sizable orders at the present time, covering linotype and monotype controls, electric melting pots and affiliated specialties. A milk company in New York has contracted for a 200-kva. generator with a maker in Pennsylvania for a creamery plant in Texas, including switchboard and other equipment, and an order for two 150-hp. boilers has been placed with a New York manufacturer.

While marine account is temporarily lagging, manufacturers are looking forward to sizable orders in the early future. The approval of the cruiser bill, authorizing the construction of fifteen 10,000-ton government cruisers, is expected to bring the market to high level. A manufacturer of control apparatus reports an order for equipment for refitting an existing cruiser. Street-lighting equipment is developing good proportions and a number of municipalities are in the market; traffic control installations, also, are maturing to excellent promise, and a manufacturer reports a good volume of inquiries. A metropolitan city has recently placed a contract for apparatus of this kind to an amount of $30,000. A maker of fuses reports business as spotty and inquiries unsatisfactory. A jobber of electrical specialties says that trade is fair but the keenness of competition is tending to reduce prices. Construction projects are as follows:

The American Aeronautical Corporation, New York, will build an aircraft plant and air terminal at Port Washington, L. I., to cost $1,000,000. The Century Carbon Company, New York, plans a plant near Crew Lake, vicinity of Monroe, La., to cost $500,000. The Erie Railroad Company, New York will make expansions at its shops at Susquehanna, Pa., to cost $350,000, and has made an appropriation of $1,029,700, for the purchase of marine equipment of various kinds, including a Diesel lighter. The Continental Can Company, New York, plans a branch plant at Oakland, Calif., to cost $500,000. The Eureka Smelting Company, New York, will build a copper smelting plant at Blackburn, Nev., in connection with expansion program to cost $5,000,000. The New York Power & Light Corporation, Albany, will make extensions in transmission lines at Hampton, N. Y., and vicinity.

The Philadelphia Electric Company, Philadelphia, will build a power substation on Cuthbert Street. The General Electric Company, Philadelphia, plans a storage and distributing plant to cost $150,000. The Pennsylvania Railroad Company, Philadelphia, plans an express terminal to cost $3,000,000. The Lancaster Airways Company, Lancaster, Pa., plans improved lighting equipment at its field. The Magee Carpet Company, Bloomsburg, Pa., will build an addition to cost $125,000. The United Railways & Electric Company, Baltimore, plans a motor bus service and repair building to cost $275,000. The Maryland Creamery Company, Baltimore, plans an ice cream factory to cost $100,000.

Power Equipment Sales Increase in New England

Steady demand for power equipment for mills and plants is reported in the New England district. Motor sales continue steadily while power plant equipment inquiries are increasing and central-station supplies are moving well.

The demand for larger motors for machinery drive and turbo-generators is encouraging. Negotiations were opened for a number of units, including several small turbo-generators from 150 kw. up, and another order soon to be placed includes a 30,000-kw. unit. Recently an order for a 20,000-kw. unit and accessories amounting to over $80,000 was ordered for Southern delivery, and another order for a 2,500 kw. unit for a New England mill is recorded. Motor sales are steady with orders for large sizes increasing and recently a group of loom motors was ordered for a New England mill. Several orders for 100 to 200-hp. motors in single lots are reported. Small switch and control apparatus is in good demand. New additions to industrials are increasing while loads are being added and transformer sales are growing steadily as compared with last month. Central-station supplies are receiving more attention and negotiations are active for projected substation plans. Electric furnace manufacturers report increasing interest in electric pot furnaces and special units of the continuous-type feed for heat treatment. Construction projects are as follows:

The Fraser Paper, Ltd., Madawaska, Me., plans extensions in its mill to cost $150,000. The Cranston Print Works, Cranston, R. I., will build an addition to its textile mill to cost $100,000. The United States Coast Guard, Washington, D. C., plans a power plant in connection with the proposed coast guard academy at New London, Conn., to cost $2,000,000.

Current Business Limited in Southeast

A satisfactory activity, with increases in central-station purchases, is reported for the Southeast. Inquiries on central-station supplies, particularly substation equipment, also are satisfactory and some outstanding orders should follow within the next few weeks. Industrial activities seem confined mainly to pending projects, of which there are a good number. The largest central-station order reported was for 900,000 lb. of aluminum cable for a Georgia company. The approach of warmer weather has accelerated the movement of arrester equipment, one of the orders for this equipment amounting to $22,000. In connection with one transmission line project a Georgia company ordered 49 miles of bare stranded copper wire and creosoted pine poles totaling $3,000. Some other power company orders were for creosoted pine poles totaling $5,600 and for No. 2 bare stranded copper amounting to $5,500. One company's miscellaneous switching equipment or-

ders aggregated $3,100. A Georgia company is in the market for two carloads of bare and weatherproof wire, while a company in Tennessee has asked bids on similar equipment which will aggregate one carload.

In connection with an 18,000-spindle addition to a tire-fabric mill in North Georgia, 1,000 hp. in motor equipment will be ordered and a rubber reclamation plant to be constructed in Alabama will require approximately 3,000 hp. in motors. Jobbers report their business as satisfactory. Construction projects are as follows:

The Chesapeake Corporation, West Point, Va., plans an expansion in its mill to cost $350,000. The Richmond Sand & Gravel Company, Richmond, Va., plans a plant to cost $250,000. Wheeling, W. Va., plans an ornamental lighting system. Swift & Company, Chicago, contemplate a creamery plant at Lexington, Ky., to cost $100,000. The Cumberland Public Service Company, Burkesville, Ky., will make extensions in its electric power station and ice-manufacturing plant, to cost $60,000. The Tennessee Products Corporation, Nashville, Tenn., will build an addition to the byproduct coke works at Chattanooga, Tenn., to cost $400,000. The Sterling Wood Products Company, Knoxville, Tenn., plans an addition to its automobile body plant to cost $100,000. The Richland Power Company, Columbia, S. C., plans a hydro-electric power plant on the Saluda River, with initial capacity of 30,000 hp., to cost $650,000, with transmission line. The Southern Public Utilities, Inc., Charlotte, N. C., is acquiring the municipal light and power plant at Blacksburg, S. C., and plans extensions to cost $75,000. The Gulf Ice & Cold Storage Company, Ozark, Ala., plans a cold storage and refrigerating plant to cost $70,000. Daytona Beach, Fla., plans a floodlighting system and beacon lamps in connection with its municipal airport, to cost $100,000.

Heavy Building Planned in St. Louis District

The demand for contractors' building supplies has held up splendidly in the St. Louis district. Indications now point to a large building program opening early this spring. A large power distributing company has bought switching equipment aggregating $116,000, consisting of circuit breakers, substation automatic control panels and accessories. Other orders of contract size are for a 2,500-kw. turbo unit for the southwestern part of this district to cost $47,000, a 187-kw. generator for a small city in Illinois costing $3,000, a lot of auxiliary motors to cost $5,000 and 35 oil-well pumping motors costing $15,000 for an oil-producing company in the Southwest. Another lot of motors for general industrial use to cost $10,000 completes the week's reports. Construction projects are as follows:

The Missouri Utilities Company, St. Louis, contemplates an ornamental lighting system at Sikeston, Mo. Harrisonville, Mo., plans a municipal electric light and power plant to cost $50,000. St. Louis, Mo., plans a floodlighting system and beacon lamps at its municipal airport to cost $100,000. The Metal Craft Corporation, St. Louis, plans a toy-manufacturing plant to cost $85,000. The Missouri Pacific Railway Company, St. Louis, plans an addition to engine house and shops at Osawatomie, Kan., to cost $85,000. The Braley School of Flying, Wichita, Kan., plans an aircraft plant to cost $125,000. The Texas Power & Light Company, Dallas, Tex., plans a steam-operated electric power plant at Blanco, Tex. Austin, Tex., plans a floodlighting system and beacon lamps in connection with airport expansion to cost $80,000. Dallas, Tex., plans extensions in the ornamental lighting system on Commerce, Main and Elm Streets. The Texas Gypsum Products Company, Finlay, Tex., plans a plant for the manufacture of gypsum building materials, to cost $160,000. The Panhandle Power & Light Company, Borger, Tex., plans 66,000-volt transmission lines in vicinity of Wheeler and Zybach, Tex., The Industrial Gas Company, Shreveport, La., plans a carbon-black manufacturing plant near Alto, La., to cost $400,000.

Many Equipment Orders Placed on Pacific Coast

Buying is fair and limited to staples on the Pacific Coast. Orders are well distributed among various branches and include carloads of treated poles for Milton, San Jose and Pinole, Calif., a carload of rigid iron conduit for an elevator company, a carload each of 10-in. pole steps and 4-in. fiber conduit for power company stock and a half carload of ½-in. Siemens-Martin strand and 4,000 12½-in. leaded-top steel pins. Machinery manufacturers report staple sales only in motors, transformers and meters, the outstanding orders being five Westinghouse oil circuit breakers, sizes 11,000 to 100,000 kva., valued at $40,000 for installation in various Great Western power stations and 15 street-lighting regulating transformers valued at $15,000. Street-lighting orders include 220 Westinghouse tops valued at $13,000 for Honolulu, 56 for Pittsburg, Calif., valued at $2,000 and 72 for Stockton, Calif., valued at $3,500. The cities of San Mateo and Porterville, Calif., are planning new street-lighting systems. The projected building construction is unusually heavy and contains such major items as a $2,000,000 skyscraper church for Oakland, a $1,000,000 theater and office building for Hollywood, the $1,000,000 William Wrigley residence for Catalina Island and a $2,000,000 marine corps hospital for San Francisco.

Sales volume to industrial sources continuing extremely light in the Puget Sound district and central stations are buying only as needed. The city of Tacoma plans the immediate construction of a 50,000-volt power line from Nisqually, Wash., to the tide-flats substation, the work involving an $85,000 outlay. Electorate of Centralia, Wash., on February 25 voted to construct a $955,000 municipal hydro-electric plant on the Nisqually River. The city of Seattle is taking bids for 10,000 eight-pin standard crossarms. The projects proposed in the Northwest include a $2,000,000 pulp plant at Port Orchard, a $150,000 pulp mill utilizing straw at Palouse, a $300,000 chemical plant on the Priest River near Spokane and the $1,500,000 first unit of a steel mill in Vancouver, B. C. Construction projects are as follows:

The Southern California Edison Company, Los Angeles, plans a power substation at Saugus, Calif., to cost $130,000. San Francisco will soon take bids for an electric traffic signal system to cost $70,000. The Van de Kamp's Holland-Dutch Bakers, Inc., Los Angeles, plans a baking plant to cost $250,000. The Fraser Gas Furnace Company, Stockton, Calif., will build an industrial furnace manufacturing plant to cost $65,000. The Willys-Overland Company, Toledo, Ohio, plans an addition to its automobile assembling plant at Los Angeles, to cost $400,000. The Adohr Creamery Company, Long Beach, Calif., will soon take bids for a power plant to cost $70,000. Los Angeles, Sacramento, Alameda, El Monte, South San Francisco and Richmond, Calif., plan ornamental lighting systems. The Continental Baking Company, San Francisco, plans a baking plant to cost $200,000. Tacoma, Wash., plans a municipal grain elevator to cost $500,000. The Willapa Pulp & Paper Mills, South Bend, Wash., will build an addition to cost $400,000. The Public Service Company of Colorado, Denver, plans extensions in transmission lines in vicinity of Alamosa and Blanca, Colo., to cost $70,000. The Norton Dairy Company, Phoenix, Ariz., plans a creamery plant to cost $100,000. Tucson, Ariz., plans an electric police and fire alarm system to cost $25,000. Fort Collins, Colo., and Gallup, N. M., plan ornamental lighting systems.

Volume of Business Good in Middle West

While an apparent lag is noticeable in some lines, the general volume of business is appreciably large and well diversified in the Middle West. The railroads continue to place equipment orders and carloadings are comparatively high. The various utility companies are busy with a large amount of overhead construction work while maintenance purchasing is quite heavy, one large utility company averaging $115,000 per day. Some interesting orders that have been placed include meter and control equipment valued at $25,000, pole line hardware valued at $50,000, "Mazda" lamps valued at $150,000 and several construction orders aggregating $100,000. Jobbers' sales are normal. Construction projects are as follows:

The Wisconsin Power & Light Company, Madison, Wis., will soon take bids for an addition to its power plant at Beloit, Wis., to cost $50,000. Manitowoc, Wis., will take bids until March 14 for equipment for its municipal power plant, in connection with expansion program to cost $250,000. The American Lace Paper Company, Milwaukee, Wis., is asking bids for an addition to cost $100,000. The Prairie du Chien Woolen Mills, Prairie du Chien, Wis., plans a power station addition to cost $85,000. The Continental Baking Company, Detroit, plans a baking plant addition to cost $150,000. The Lefere Forge & Machine Company, Jackson, Mich., plans a plant to cost $100,000. The Checker Cab Company, Kalamazoo, Mich., contemplates an addition in its taxicab manufacturing plant to cost $100,000. The By-Products Coke Corporation, Chicago, plans an addition in its plant including ore docks, with mechanical handling equip-

ment to cost $1,500,000. The Bell & Howell Company, Chicago, plans an addition to its motion picture projector manufacturing plant to cost $100,000. The General Laundry Machinery Company, Chicago, plans an addition to cost $100,000. The Schlangen Brothers Company, Chicago, will build an addition for the manufacture of hardware products to cost $200,000. The Illinois Steel Company, Chicago, plans additions to its mill at Carey, Ind., to cost $6,000,000. The Chrysler Corporation, Detroit, will build an addition to its automobile plant at Newcastle, Ind., to cost $150,000. The Cambridge Tile Manufacturing Company, Covington, Ky., plans a plant at Cincinnati, Ohio, to cost $1,000,000. The Cincinnati Sheet Metal & Roofing Company, Cincinnati, Ohio, will make extensions in its plant to cost $80,000. The Electric Auto-Lite Company, Toledo, Ohio, plans three plant additions, to cost $350,000. The Carthage Mills, Inc., Cincinnati, Ohio, plans an addition to its floor covering manufacturing plant to cost $115,000. The Thompson Products Company, Cleveland, plans an addition to its automobile equipment plant to cost $150,000.

Copper and Lead Prices Continue to Advance

Prices of copper and lead continued their upward progress during the week ending Wednesday. The latest buying spurt in copper has forced it up to 18.75 cents per pound Connecticut basis from the 18-cent price prevailing a week ago, and the copper market appears destined to become a "runaway" affair if consuming demand is not curbed. Domestic lead producers report that consuming demand is being maintained.

NEW YORK METAL MARKET PRICES

	Feb. 20, 1929 Cents per Pound	Feb. 27, 1929 Cents per Pound
Copper, electrolytic	18.	19
Lead, Am. S. & R. price	6.95	7.125
Antimony	9.66	9.25
Nickel, ingot	35	35
Zinc, spot	6.70	6.70
Tin, Straits	49.125	49
Aluminum, 99 per cent.	24.30	24.30

Base copper wire price Feb. 27, 1929, 20¾ cents.

Activities of the Trade

Canadian General Electric Sells Firm

The Industrial Acceptance Corporation, which purchased the General Contract Purchase Corporation, has now bought the Canadian Contract Purchase Corporation from the Canadian General Electric Company, Ltd. The Industrial Acceptance Corporation already has an installment financing company in Canada, the Industrial Acceptance Corporation of Canada, which does a general finance business on automobiles, etc.

New Refrigerator Simplified and Compact

Simplicity and compactness are the leading features of the new electric refrigerator just announced by the Holmes Products, Inc., of New York City. The operating unit is stated to be so compact that it fits easily into half of the base of the refrigerator, leaving the remaining section free for food products. According to the producers, this refrigerator unit has no belts, gears, pulleys, stuffing box or chains. It requires no oiling and all moving parts are permanently lubricated by a bath of oil. The rotary principle is another feature of this refrigerator.

A new method of distribution has been adopted. Distributors are appointed throughout the country with protected territory. They, in turn, enfranchise representative retailers, who also have protected territory, which, it is stated, practically eliminates door-to-door selling.

The Holmes Products, Inc., is headed by Julius Fleischmann Holmes, president, a former executive of the Fleischmann Company; John F. Plummer, vice-president and general manager, and Hamilton L. Shields, secretary and treasurer. The general sales manager is John M. Bickel.

Conference by Sales Managers of Edison Lamp Works

The Edison Lamp Works of the General Electric Company, Harrison, N. J., held its annual midwinter conference of the district sales managers on February 18, 19 and 20. After a two-day discussion of sales plans and merchandising activities to be carried out through the remainder of the year, the conferees listened to a series of interesting talks given by B. C. Forbes, editor of *Forbes Magazine*; T. H. Beck, editorial director of *Collier's Weekly*; W. W. Freeman, vice-president of the Columbia Gas & Electric Engineering Corporation; A. Pryor, Jr., and E. H. Ramsdell, both of Batten, Barton, Durstine & Osborne.

General Course in Illumination Held at Nela Park

The twenty-fourth general course in illumination was held at the Nela School of Lighting of the General Electric Company at Nela Park, Cleveland, on February 11 to 16. Approximately 35 men from all parts of the country attended this school. Classes of instruction were held, during which time many of the lighting specialists and engineers of the National Lamp Works offered up-to-the-minute information on the lighting business.

Although most of the time was spent in actual class work, several trips were made to various manufacturing concerns in order to obtain practical information on factory lighting. At the close of this school diplomas were given to those who had successfully passed the course.

General Electric Reduces "Mazda" Lamp Prices

The General Electric Company announces that the "Mazda" lamp prices have again been reduced on the 50- and 60-watt lamps of the standard line of inside frosted lamps. Price reductions also have been made on all colored lamps except flame tints. This is the twelfth time that "Mazda" lamp prices have been reduced since 1920. The present reduction of approximately 10 per cent brings the prices of these lamps to about one-half of the 1914 prices.

Lamp Size	Old Price, Cents	New Price, Cents
50-watt (A)	22	20
60-watt (A)	22	20
25-watt (colored)	30	25
40-watt (colored)	30	25

Westinghouse Given Large Canadian Hydro Contract

Announcement is made by the Canadian Westinghouse Company that it has been awarded the contract for the generator for the tenth unit which will be installed in the power house at Queenston for the Ontario Hydro-Electric Power Commission.

Work on the entire unit has been authorized and arrangements are being made to commence at once on the enlargement of the forebay excavation for the screenhouse at the entrance to the 16-ft. diameter penstock to be constructed over the cliff. In addition to the generator, there has to be built specially for the purpose a turbine unit, transformer and auxiliary equipment. The total estimated expenditure is approximately $5,000,000. The capacity of the new generator is to be 62,000 hp. and its cost in the neighborhood of half a million dollars.

Eighteen months will be required to finish the work, after which the power house itself will be completed.

THE STEEL & TUBES, INC., Cleveland, manufacturer of "Steeltubes" electrical metallic tubing, announces that the headquarters of its electrical division has been removed to the company's New York plant, located at Scott and Meserole Streets, Brooklyn. Morgan P. Ellis has been elected vice-president and general manager of the company, and Murray S. Whitfield, formerly the Cleveland district manager of the Chicago-Jefferson Fuse Manufacturing Company, has been appointed sales manager of the electrical division. The following is a list of electrical division

representatives in the Eastern district: James J. Coughlin, district sales manager, with headquarters at 347 Madison Avenue, New York City; C. F. Resseguie, district sales manager with headquarters at 10 South Eighteenth Street, Philadelphia; Thomas D. Mitchell, district sales manager, located at 912 Garrett Building, Baltimore; John R. Wilkins, district sales manager, with headquarters at 176 Federal Street, Boston, and M. F. Stranahan, district sales manager for New York state.

THE WESTINGHOUSE LAMP COMPANY, 150 Broadway, New York City, announces a 10 per cent reduction in the price of the standard 50- and 60-watt "Mazda" lamps, making the list price of all standard household sizes, from 15 to 60 watts, 20 cents. Prices on the 10- and 25-watt sizes in colored lamps and the 40-watt ivory and old rose have been reduced to 25 cents from 30 cents.

THE TIMKEN ROLLER BEARING COMPANY, Canton, Ohio, announces that H. H. Wood, formerly chief engineer of the Laclede Steel Company of St. Louis, has joined the industrial department of its company. Mr. Wood will specialize in the application of Timken bearings to steel mill equipment of various sorts.

THE F. W. WAKEFIELD BRASS COMPANY, Vermilion, Ohio, manufacturer of "Red Spot" commercial lighting equipment, reports that on February 1 its orders on hand for immediate production were larger than any time during the company's more than 30 years of operation.

THE MOLONEY ELECTRIC COMPANY, St. Louis, manufacturer of transformers, announces the opening of a branch sales office in Atlanta, Ga., and A. R. Pierson, Jr., has been appointed district manager of this office, which is located at 101 Marietta Street. The company also announces the appointment of G. A. Wright as district manager in charge of the Indianapolis office, which is located at 511 Traction Terminal Building.

THE JAMES R. KEARNEY CORPORATION, 4224 Clayton Avenue, St. Louis, manufacturer of overhead and underground utility equipment, announces the following additions to its sales organization: C. P. Wenner, covering part of Ohio, Indiana, Pennsylvania and Michigan; T. G. Carter, covering part of Tennessee, Arkansas, Mississippi and Louisiana; G. R. Emerson, covering part of Maryland, Virginia and West Virginia, and M. Tipsord, demonstrating engineer of the Kearney live line tools and accessories located in St. Louis.

THE METROPOLITAN DEVICE CORPORATION, 1250 Atlantic Avenue, Brooklyn, N. Y., manufacturer of the "Murray" protective devices, distribution equipment and the "Murray" electric radiators, announces the appointment of William J. McIlvane as general sales manager of its company. Mr. McIlvane was formerly with the Copperweld Steel Company, Glassport, Pa., as district sales manager east of the Mississippi.

New Equipment Available

Water-Cooled Carbon Electrode Holder

The perfection of what is stated to be an entirely new type water-cooled carbon electrode holder for heavy-duty manual welding by the carbon arc

process is announced by the Lincoln Electric Company of Cleveland, Ohio. As it is possible to weld with the arc tip of the carbon electrode projecting less than 3 in. from the carbon holder there is less carbon area heated, thereby greatly reducing the vaporization of the carbon. It is thus possible to use smaller carbons with higher current density, which effects a decided saving in electrode costs.

One of the unique features which contributes to the lightness of the holder is the use of the hose which carries the water also to carry the cable to the holder. Each of the water tubes contains a small light cable from the connector to the holder. The water pouring through the holder also acts as a cooling agent for the cables. Thus the size of the cable is reduced greatly.

The carbon holder consists of coiled copper tubing through which water constantly circulates, the carbon electrode being inserted through the coil. The carbon holders are manufactured in sizes for use with $\frac{1}{4}$-in., $\frac{5}{16}$-in., $\frac{3}{8}$-in. and $\frac{1}{2}$-in. carbons.

Across-the-Line Switch Is Oil-Immersed

A small oil-immersed switch for use in throwing small alternating or direct current motors across the line has been developed by the General Electric Company. It is a simple device having a minimum of component parts—a one-piece cast-iron cover, including the switch mechanism, and a small cast-iron tank for the oil.

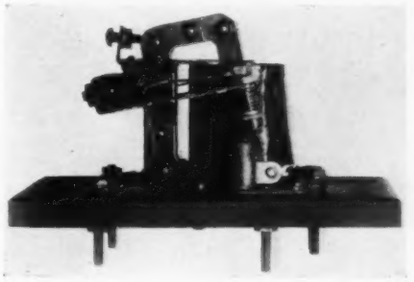
The molded compound switch base carries the stationary contact stud parts and the moving contact assembly is mounted on another one-piece molded part. The contacts are of the silver-to-silver double-break type. The use of these contacts and of the molded arm is to eliminate shunts or drum-type contacts.

The advantages of the device as claimed by the manufacturer are, first, double-break separately insulated contacts, free from shunts or drum fingers; second, molded insulation, giving excellent creepages and clearances; third, simple and adequate means for mounting and conduit connections; fourth, small, compact design, giving oil-immersed feature.

Relay for Lighting Control Circuit

A new relay for lighting control circuits such as thermostats and heat regulators has been developed by the Sundh Electric Company, Inc., Newark, N. J. These relays are being manufactured in 3- and 6-amp. sizes for all voltages from 6 to 550 volts and one, two, three and four poles. They will also be manufactured in two-pole, double-throw, using one magnet.

The feature claimed for this relay is that it opens the circuit very rapidly and is free from binding or residual,



although of light construction, requiring very low wattage. There are no iron to iron bearings and all current-carrying parts are made of copper.

Cross-the-Line Motor Starter

The Condit Electrical Manufacturing Corporation, Boston, Mass., announces the placing on the market March 4 of a new starter known as its type A-30, for use with squirrel-cage induction motors up to 20 hp. rating on 440 and 550 volts, 15 hp. on 220 volts and 7.5 hp. on 110 volts. The starter utilizes a design to prevent arc formation by practically eliminating ionization when interrupting the circuit. The company

states that exhaustive tests show that there is only a spark when interrupting six to seven times normal current, with relatively no contact burning or gas, minimizing maintenance. It reports that the starter, when tested with a 20-hp., 440-volt, squirrel-cage induction motor, opened and closed the locked rotor current at ten-second intervals 37 times before motor heating stopped the test, and without an arc at any interruption. The starter has no barriers or arc chutes and is equipped with thermal relays for time-lag overload protection and arranged for undervoltage protection.

"Turn-Pull" Switch for Circuit Breakers

A new control switch for the remote operation of circuit breakers has been placed on the market by the General Electric Company. This switch is known as the "Turn-Pull" switch because of the fact that a combined turning and in or out motion is required to operate it.

The handle is oval in shape and carries a metal strip insert which makes it possible to tell at a glance which operation was last carried out by the attendant. There are two positions of the handle, right for close and left for trip.

The main closing and tripping contacts are of the pivoted shoe type and are operated by the initial outward or inward motion of the switch shaft. The turning motion then operates four auxiliary silver-tipped contacts through the action of cams. Two of the latter contacts are placed in series with the main contacts, so that it is impossible to actuate the circuit breaker until the indicating switch handle is swung into the right or left position. The second pair of contacts are used singly, one for an indicating lamp and the other in the alarm bell circuit.

Electrical Patents

Announced by U. S. Patent Office

(Issued February 12, 1929)

17,214 (reissue). PRIMARY CUT-OUT; N. J. Conrad, Winnetka, Ill. App. filed March 7, 1919.

1,701,532. MECHANISM FOR AND METHOD OF FORMING WIRE ARTICLES; J. M. Glaser, Buffalo, N. Y. App. filed March 12, 1927.

1,701,564. CONTROL FOR CONTINUOUS PROJECTORS; F. M. Hall, Pasadena, Calif. App. filed Dec. 15, 1926.

1,701,634. RELAY; H. O. Putt, Elkhart, Ind. App. filed Nov. 5, 1925.

1,701,646. CONNECTING CABLE AND PLUG THEREFOR; L. R. Taylor, Milwaukee, Wis. App. filed March 22, 1922.

1,701,671. DIFFERENTIAL ELECTRIC DISTANT CONTROL DEVICE COMPRISING STATIC TRANSMITTERS; E. Granat, Paris, France. App. filed Aug. 3, 1926.

1,701,676. REGULATING APPARATUS; G. E. Hulse, New Haven, Conn. App. filed Jan. 20, 1925.

1,701,677. MACHINE FOR PREPARING TOAST, TOASTED SANDWICHES, BAKED WAFFLES, AND THE LIKE; F. E. Hummel and J. J. Noeth, Chicago, Ill. App. filed Jan. 6, 1925.

1,701,680. THERMAL CIRCUIT CLOSER; J. M. Johnson, Kansas City, Mo. App. filed Jan. 20, 1927.

1,701,715. ELECTRIC LOAD-LIMITING DEVICE; J. Batchelder, Muskegon Heights, Mich. App. filed Feb. 15, 1928.

1,701,716. HEATING APPARATUS; C. S. Brown, Nashville, Tenn. App. filed Dec. 13, 1924.

1,701,725. SWITCH MOUNTING; O. J. Moehler, Newark, N. J. App. filed June 21, 1927.

1,701,730. SYSTEM OF CONTROL FOR ELECTRIC-ELEVATOR EQUIPMENT; C. H. Roth and M. Schiff, Chicago, Ill. App. filed Sept. 6, 1924.

1,701,751. CURRENT RECTIFIER AND VOLTAGE REGULATOR AND CIRCUITS THEREFOR; T. E. Foulke, Nutley, N. J. App. filed July 9, 1927.

1,701,761. AUTOMATIC SWITCH; P. B. Parks, Oak Park, and D. W. Miller, Elmhurst, Ill. App. filed Feb. 2, 1927.

1,701,774. CURRENT LIMITING AND REGULATING APPARATUS; A. Guerra, Mexico City, Mex. App. filed Nov. 12, 1925.

1,701,801. ELECTRIC-WIRE TERMINAL; L. Van Gale, Astoria, N. Y. App. filed Feb. 8, 1924.

1,701,808. HIGH-TENSION CABLE; A. O. Hoeftmann, Worcester, Mass. App. filed April 9, 1927.

1,701,843. METHOD OF WELDING WIRE WHEELS; H. Ford, Dearborn, Mich. App. filed Dec. 31, 1924.

Information on foreign patents can be obtained through the nearest district office of the Bureau of Foreign and Domestic Commerce, Department of Commerce.

1,701,858. SOLDERING IRON; J. F. Lamb, New Britain, Conn. App. filed Jan. 29, 1925.

1,701,877. DISCONNECTING DEVICE; W. Foster, Philadelphia, Pa. App. filed Nov. 5, 1925.

1,701,884. OIL-WELL HEATER; J. E. Hogle, Indianapolis, Ind. App. filed Sept. 30, 1927.

1,701,894. ELECTRICAL SOLDERING DEVICE; E. J. McCue, Brooklyn, N. Y. App. filed Feb. 11, 1928.

1,701,919. METHOD AND ROTATING DISK FOR CUTTING METALS BY THE AID OF AN ELETRIC CURRENT; O. F. A. E. Grumpelt, Hamburg, Germany. App. filed Feb. 17, 1925.

1,701,975. DEVICE FOR INDICATING SMALL CHANGES OF CAPACITY; R. Gunn, Washington, D. C. App. filed May 28, 1924.

1,702,035. CIRCUIT CONTROLLER; G. W. Berthold, Chicago, Ill. App. filed Oct. 29, 1924.

1,702,049. RAILWAY-SWITCH CONTROLLER; R. M. Gilson, Pittsburgh, Pa. App. filed April 23, 1925.

1,702,072. TRANSFORMER FOR AMPLIFIER DEVICES; F. Carbenay, Paris, France. App. filed May 17, 1923.

1,702,073. VARIABLE INDUCTANCE; N. H. Clough, Chelmsford, England. App. filed June 27, 1925.

1,702,075. HIGH-SPEED RELAY; H. Chireix and L. Philippart, Paris, France. App. filed April 28, 1922.

1,702,078. LABORATORY HEATER; H. Goldberg, Chicago, Ill. App. filed Aug. 8, 1925.

1,702,082. OSCILLATOR MAGNETO; W. W. Hawkins, Brooklyn, N. Y. App. filed Feb. 20, 1922.

1,702,089. ELECTRICAL HEATING UTENSIL; E. J. Rohne, Minneapolis, Minn. App. filed June 21, 1926.

1,702,122. SOCKET FOR AUDION TUBES; C. R. Krone, Oakland, Calif. App. filed May 24, 1926.

1,702,124. CONDUCTOR SUPPORT; S. S. Matthes, Mansfield, Ohio. App. filed July 1, 1925.

1,702,130. RAIL BOND; P. P. Pipes, Mansfield, Ohio. App. filed Aug. 20, 1927.

1,702,135. SEPARABLE ELECTRICAL CONNECTION; T. C. Sawers and H. J. Blair, Brooklyn, N. Y. App. filed Aug. 5, 1926.

1,702,158. CONTACT OF THE PIN TYPE; W. J. Gagnon, Bridgeport, Conn. App. filed Sept. 14, 1925.

1,702,177. PLUG RECEPTACLE; W. A. Stacey, Chicago, Ill. App. filed June 7, 1922.

1,702,209. THERMOSTATIC DEVICE FOR INCUBATORS AND OTHER APPARATUS; F. Hickok, Carthage, Mo. App. filed April 23, 1925.

1,702,220. ELECTRIC SWITCH; A. H. Nero, West Hartford, Conn. App. filed May 1, 1924.

1,702,228. POWER CHANDELIER; E. M. Erb, Hartford, Conn. App. filed May 20, 1927.

1,702,235. SYSTEM OF LINE INSULATION AND INSULATORS THEREFOR; L. Steinberger, Brooklyn, N. Y. App. filed June 27, 1921.

1,702,236. HIGH-TENSION INSULATOR CONSTRUCTION; A. O. Austin, Barberton, Ohio. App. filed Oct. 20, 1921.

1,702,238. INSULATOR AND FITTING THEREFOR; A. O. Austin, Barberton, Ohio. App. filed March 1, 1923.

New Trade Literature

MOTOR DRIVE, BATTERY-CHARGING EQUIPMENT, ETC.—The General Electric Company, Schenectady, N. Y., is distributing the following bulletins: GEA-1082, describing and illustrating its electric motor drive for cotton cards; GEA-1083, covering the electric motor drive for spinning and twisting frames; GEA-1088, covering the G-E battery-charging equipment; GEA-432A, describing its type CD direct-current generators and exciters, and GEA-1075, describing and illustrating its temperature-indicating equipments for alternating-current generators and motors.

LIFTING MAGNETS. — "Modern Metal Handling Methods" is the title of a catalog issued by Cutler-Hammer, Inc., Milwaukee. It contains photographs to show the application of the magnets to the various kinds of work in foundries, junk yards, steel plants and miscellaneous industries and describes in detail the constructional features of the magnets.

ELECTRIC WASHER. — The Altorfer Brothers Company, Peoria, Ill., is distributing circulars covering its new model porcelain electric washer known as the "Apartment."

ELECTRIC FURNACE.—H. O. Swoboda, Inc., 3400 Forbes Street, Pittsburgh, is distributing bulletin No. 140, which describes its "Falcon" continuous electric furnace for heat treating strip metal and wire.

ROLLER BEARINGS.—"Wherever Wheels and Shafts Turn" is the title of a catalog issued by the Timken Roller Bearing Company, Canton, Ohio. It contains many illustrations and shows how universal Timken bearings have become in every kind of equipment, how they have effected radical savings wherever wheels and shafts turn throughout industry and technical information on bearing mountings and installations.

FUSED SWITCHES.—A pamphlet issued by the W. N. Matthews Corporation, 3720 Forest Park Boulevard, St. Louis, covers the new "800" Matthews "Fuswitch" with wet process porcelain housing.

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered, further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number:

An agency is desired in Paris, France (No. 36,370), for electric fans, clamp lights, etc., and insulated enameled wire for radios.

A sole agency is desired in Bombay, India (No. 36,369), for household electrical appliances.

Purchase is desired in Montreal, Canada (No. 36,437), of table lamps and small night lamps.

Purchase and agency are desired in Quebec, Canada (No. 36,438), for electric refrigerators for household and commercial use.

Any manufacturer desiring to establish agencies abroad may consult with the nearest district office of the Bureau of Foreign and Domestic Commerce, Department of Commerce, where data on available agencies throughout the world are on file.

Business Facts for Electrical Men

Selected Statistics Presented Graphically for
the Use of All Interested in Analyzing the
Trend of the Electrical Business

Young Industries Lean Toward Purchased Energy

Canada's abundant water power and rapid industrial growth
favor use of electrical energy

AS A manufacturing country Canada is a comparative newcomer. Her industries, being young, could readily adapt themselves to modern conditions.

Some of the possibilities in the direction of further electrification of industries in the United States, and also some instances of conditions more favorable to electrical operation south of the international line than north of it, emerge from a comparison of figures in a recent bulletin from the Dominion Bureau of Statistics with the most closely corresponding data of the U. S. Census of Manufactures. The former are for 1926; the latter for 1925.

Canada classifies her manufactures in nine groups; the Census Bureau uses sixteen. Group comparisons cannot be made. As a whole, our neighbor's industries use relatively more purchased energy (on the basis of installed horsepower) than our own. They operate 56 per cent of their horsepower, we 44, by purchase. With electrical operation on energy generated by the establishments reporting, the reverse is true: 29 per cent of our installed horsepower is so operated; only 13 per cent of theirs. Total electrification is therefore somewhat higher in the United States.

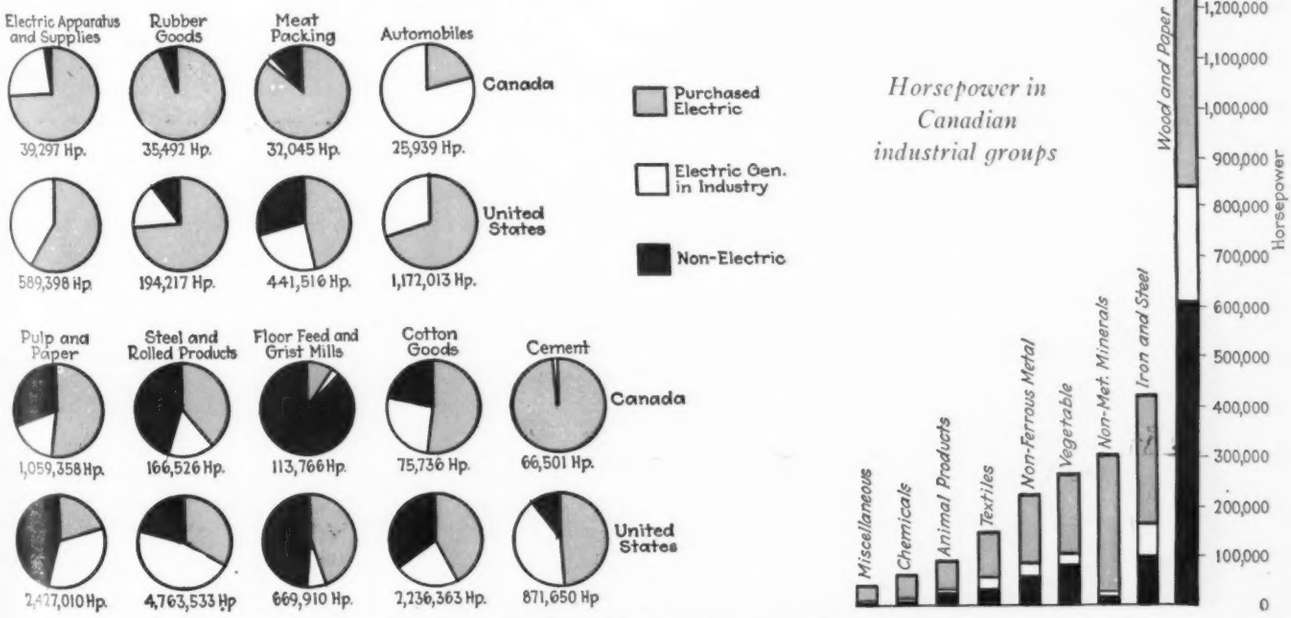
Operation on purchased energy is notably greater in Canada in the manufacture of pulp and paper, cement, and rubber goods. The table gives the percentage of motor horsepower operated on purchased energy and the percentage on energy generated in the establishment for nine important power-consuming industries in Canada, with comparative figures for the United States. For some of the others, comparison was not feasible because of apparent differences in classification.

Industry	Per Cent of Total Horsepower in Electric Motors — Canada, 1926 — Purchased	Generated	United States, 1925 — Purchased	Generated
Pulp and paper	52	17	20	34
Steel and rolled products	39	16	30	49
Flour, feed and grist mills	10	2	45	6
Cotton goods	52	26	42	23
Cement	99	1	49	41
Electrical apparatus and supplies	74	24	59	41
Rubber goods	94	0	74	16
Meat packing	78	2	47	24
Automobiles	21	79	70	30

For instance, printing and bookbinding uses purchased power almost exclusively.

The total industrial horsepower in Canada in 1926 was 3,134,248; in the United States, in 1925, 35,772,628, or about eleven times as much. Canada is a land of abundant water power. Almost all the central-station energy is generated hydraulically, against less than 40 per cent here.

Most of the data for statistics in the ELECTRICAL WORLD are gathered by it from original sources. Privilege is freely given to readers to quote or use them for any legitimate purpose. While no acknowledgment is required, users will, by crediting the ELECTRICAL WORLD, help it in obtaining and compiling further basic information.



Comparative electrification, Canada and the United States

Production in South Under Last Year

THAT the larger manufacturing plants in general in the Southern States opened the year with a continued rate of operations under last year is indicated by reports received by the ELECTRICAL WORLD on the consumption of electrical energy by about 550 manufacturing plants operating in this section. The January rate of production was 0.6 per cent under December and 3.5 per cent under January last year. The rate of operations of these plants has been under that of the same month of the year previous ever since February, 1928, the decrease under the year previous averaging around 3.5 per cent.

The textiles industry of the South reported a rate of activity during January about 2.2 per cent over January last year. This is the first month since December, 1927, that the textile industry in the South has reported a rate of operations above that of the same month in the year previous. The textile plants reached their low point of operations last July, since which time they have witnessed steadily increased operations.

The metals industry group, which includes both the iron and steel and metal-working branches, reported materially increased operations during January, reaching a rate of operations about 34 per cent above January last year.

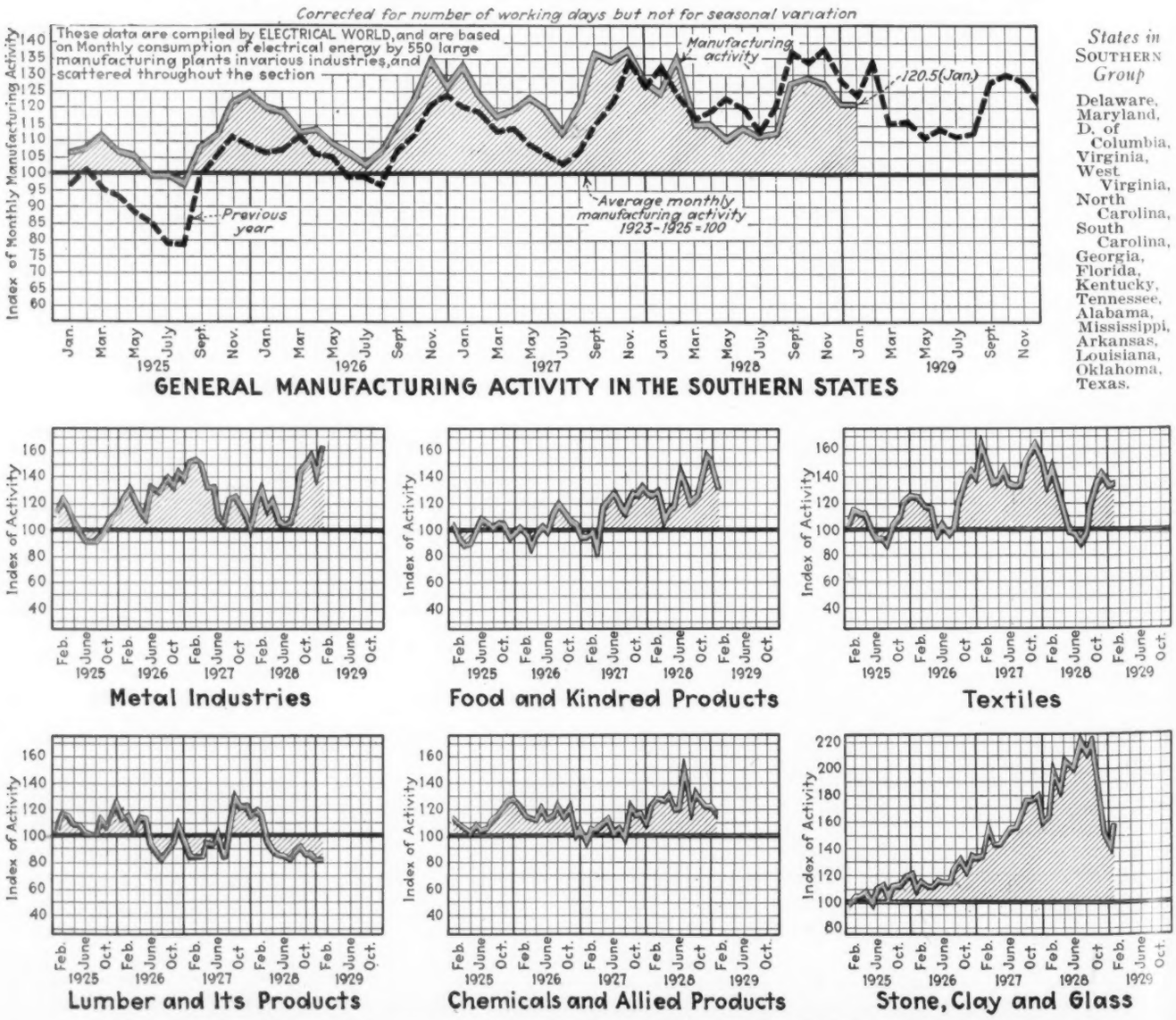
On the other hand, both the forest products and stone, clay and glass industry groups reported operations under those of January, 1928. This group has been reporting a relatively low rate of activity ever since February, 1928.

Index of Productive Activity in the Southern States

Average Monthly 1923–25 = 100
All Figures Adjusted for Number of Working Days

	January, 1929	December, 1928	January, 1928	Average for Year 1928	Average for Year 1927
All industry	120.5	121.2	124.8	120.5	125.5
Metal-industries group	160.1	139.4	119.1	125.4	125.9
Rolling mills and steel plants	192.8	159.1	136.0	141.1	134.1
Metal-working plants	123.4	117.7	102.1	108.5	.....
Food and kindred products	130.1	147.2	125.1	130.3	.....
Stone, clay and glass	144.0	141.4	161.8	189.0	156.5
Textiles	135.5	133.8	132.6	118.4	146.1
Paper and pulp	136.3	143.0	135.3	149.9	126.9
Forest products	81.3	81.3	119.0	92.1	101.8
Fertilizer industry	186.2	187.2	115.0	91.1	109.5
All industry (United States)	132.5	127.3	118.4	123.7	115.3

ELECTRICAL WORLD *Barometer of Industrial Activity in the Southern States*


Corrected for number of working days but not for seasonal variation
These data are compiled by ELECTRICAL WORLD, and are based on Monthly consumption of electrical energy by 550 large manufacturing plants in various industries, and scattered throughout the section
Index of Monthly Manufacturing Activity
Manufacturing activity
120.5 (Jan.)
Previous year
Average monthly manufacturing activity 1923-1925 = 100
Jan. Mar. May July Sept. Nov. Jan. Mar May July Sept. Nov. Jan. Mar May July Sept. Nov. Jan. Mar May July Sept. Nov. Jan. Mar May July Sept. Nov.
1925 1926 1927 1928 1929
GENERAL MANUFACTURING ACTIVITY IN THE SOUTHERN STATES
States in SOUTHERN Group
Delaware, Maryland, D. of Columbia, Virginia, West Virginia, North Carolina, South Carolina, Georgia, Florida, Kentucky, Tennessee, Alabama, Mississippi, Arkansas, Louisiana, Oklahoma, Texas.
Index of Activity
Feb. June Oct. Feb. June Oct Feb. June Oct Feb. June Oct. Feb. June Oct.
1925 1926 1927 1928 1929
Metal Industries
Food and Kindred Products
Textiles
Lumber and Its Products
Chemicals and Allied Products
Stone, Clay and Glass
MANUFACTURING ACTIVITY IN THE PRIMARY INDUSTRIES OF THE SOUTHERN STATES